JANUARY 2024

Unearthing Opportunity:
Uranium Miners and the Global Clean Energy Transition

An overview of the opportunity for uranium miners
as the world moves to decarbonize electricity production

Sprott

What Is the Clean Energy Transition?

The clean energy transition means shifting electricity production away from sources that release significant greenhouse gases, such as fossil fuels, to those that release minimal greenhouse gases. Nuclear power, hydro, wind and solar are the primary clean energy sources.

Around 60% of the world's electricity still comes from burning fossil fuels. In order to progress toward climate goals, particularly those outlined in the Paris Agreement, at least 80% of energy production will need to shift to low-carbon sources.

Source: International Atomic Energy Agency. As of 12/31/2022.

Global Energy Is at an Inflection Point

Climate change is driving the urgent need for carbon-free electricity. Energy infrastructure and commodity markets are coming into high focus. A new wave of technological changes geared toward higher energy efficiency is underway. We believe that nuclear energy and uranium miners are poised to benefit from this shift.

This white paper introduces the trends that are driving uranium markets and uranium miners, and explains our positive outlook for growth. The case for uranium mining equities comes down to three converging factors:

- First, the clean energy movement will have to embrace more nuclear power.
- Second, uranium supply is not sufficient to meet the future demand.
- Third, uranium miners represent a tiny share of the energy market today but may be poised to claim an increasing share going forward.

Nuclear power has a complicated political history. However, it represents a unique mix of attributes that renewables can't match at scale. Countries and states will need to embrace these attributes to make significant progress toward future decarbonization goals.

The Three Trends Driving Uranium Miners

❶ **New nuclear reactors are under construction or planned globally.**

To meet global decarbonization goals, countries will need to embrace nuclear power more broadly, a sentiment that is gathering global support.

❷ **Uranium mining supply shortfall may likely rise relative to growing demand.**

Uranium mining has been lower than reactor demand since the Cold War ended in 1989. Now that de-weaponized stockpiles (secondary-source uranium) have been depleted, the projected supply gap is likely to be a more pressing issue.

❸ **As nuclear power gains a greater share of global electricity generation (currently 9%),[1] uranium miners may be likely to follow.**

To meet or even approach climate change mitigation, nuclear power needs to take "share" of the energy market from high-carbon-emitting fossil fuels; uranium miners may follow suit. Geopolitical upheavals, including the Russia-Ukraine war, have also magnified the need for secure energy sources.

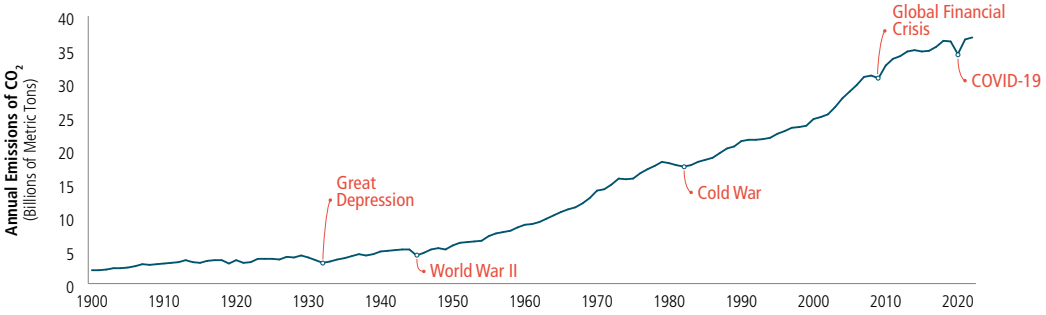
[1] Source: Ember as of 2022.

The Global Commitment to Lower Emissions

The clean energy transition has a long way to go. Today, about 60% of the world's electricity comes from carbon-producing fossil fuel sources. As the world's population has expanded and grown richer, carbon emissions have increased every year. Between 2010 and 2022, global carbon dioxide emissions climbed about 1% annually,[2] even as developed economies began to embrace green energy sources and electric vehicles in higher numbers.

Green energy is not yet replacing fossil fuel sources at scale. Researchers estimate that renewable energy production is being deployed in addition to—not instead of—fossil fuel sources. Meanwhile, emissions from surface transportation account for the continued annual growth. The COVID-19 pandemic, like prior economic downturns, did drive emissions downward, but this was only a temporary effect. As the world recovers from the pandemic, carbon emissions are resuming their upward trajectory.

Figure 1. Yearly CO_2 Emissions Continue to Rise (1900-2022)



Source: IEA, Global CO2 emissions from energy combustion and industrial processes, 1900-2022. Included for illustrative purposes only.

The Paris Agreement and the Net-Zero Movement

The drive to mitigate climate change has been gaining strong momentum. The Paris Agreement, an international treaty signed in 2015 and now ratified by 194 countries and the European Union (EU),[3] established the global framework for cooperative efforts to address climate change. To date, only a handful of countries in the Middle East have not ratified the agreement. The Paris Agreement sets out shared goals, a framework of shared resources, and a monitoring system for parties to measure and report on their progress. However, the real work of implementing green technologies falls on each country individually.

Currently, 97 parties representing 101 countries and 80.7% of global greenhouse gas emissions have communicated a net-zero target. Parties have net-zero targets outlined in laws, including Canada, the EU, Japan, South Korea and New Zealand. Other major nations, such as the United States, China, India and Brazil, have included net-zero targets in policy documents. Countries that have not submitted net-zero documentation are generally developing nations.[4]

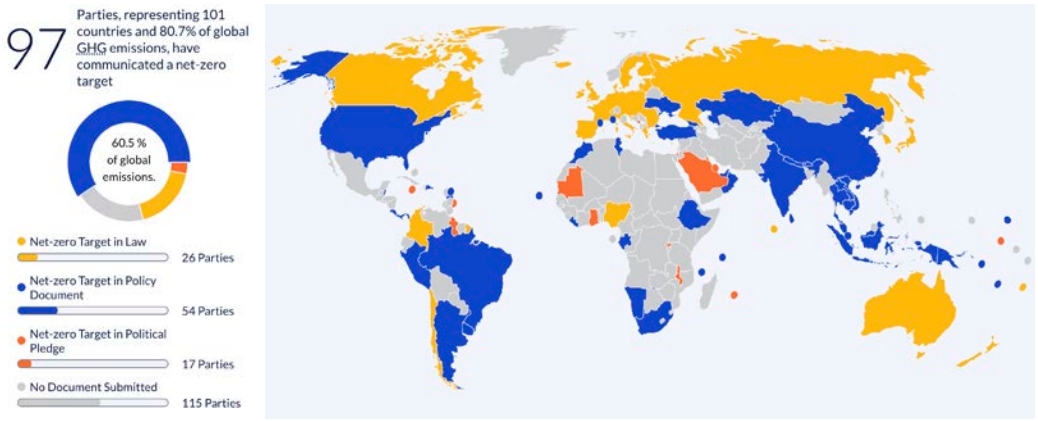
[2] Source: Global Carbon Project as of 2/1/2024. https://earthobservatory.nasa.gov/world-of-change/global-temperatures.
[3] Source: https://unfccc.int/process/the-paris-agreement/status-of-ratification.
[4] Source: climatewatchdata.org as of 1/10/2024.

Carbon Neutrality and Net-Zero, Defined

"Carbon neutrality" is a state of equilibrium between carbon produced and carbon captured/sequestered. Carbon neutrality relies first on eliminating carbon emissions as much as possible. Remaining carbon emissions are neutralized with an equivalent carbon offset.

"Net-zero" is a term often used interchangeably with carbon neutrality. However, the phrase can also be used to indicate broader greenhouse gas impacts, including methane, nitrous oxides and other greenhouse gases.

Figure 2. Most Nations Have Committed to Net-Zero Emissions Targets



Source: climatewatchdata.org at https://www.climatewatchdata.org/net-zero-tracker as of 1/10/2024. Included for illustrative purposes only.

Decarbonization Will Require More Nuclear Power

The climate goals set in the Paris Agreement aim to limit global warming to a rise of 1.5 to 2 degrees Celsius. Scientists estimate that the world needs to cut annual fossil fuel production by 6% each year to meet the stated targets. However, the reality is that fossil fuel production is on track to rise 2%.[5]

To make significant progress, countries need to invest in infrastructure that can replace carbon-producing energy sources with carbon-free energy sources. Changes on the margin will not suffice. Small increases in renewable energy sources and incremental moves toward electric vehicles are considered low-impact tweaks that will barely move the needle.

By contrast, nuclear power has the potential to provide high-impact change that can significantly move the needle. Given that nuclear power can provide an appealing solution, sentiment has turned much more positive in recent years. Environmental advocates face the tough choices required to decarbonize economies. While there are still holdouts—particularly Germany—the political tone toward nuclear power is on the upswing.

The invasion of Ukraine by Russia has forced countries like Belgium to reexamine past policy decisions to phase out nuclear energy. The Russia-Ukraine war has highlighted the dual objectives that nuclear energy can support the clean energy transition and the need for energy security.

[5] Source: https://www.un.org/sg/en/content/sg/articles/2020-12-11/carbon-neutrality-2050-the-world%E2%80%99s-most-urgent-mission.

Figure 3. Sentiment and Government Policy Have Turned in Favor of Nuclear Power

Sources: Financial Post: 4/26/2023; Bloomberg: 1/11/2023; Gallup: 4/25/2023; The Japan News: 2/10/2023; Bloomberg: 6/16/2023; BBC: 1/11/2024; and Reuters: 10/12/2023. Included for illustrative purposes only.

The Broad Appeal of Nuclear Power

Nuclear power has faced waves of negative sentiment since the technology's early roots in weaponization. This history dates back to the 1930s-1940s and was exemplified with the U.S. atomic bombing of Japan in 1945, during World War II. Despite this dark history, nuclear power offers a mix of attributes that add up to broad appeal.

We see six main characteristics supporting the case for nuclear energy:

1. Nuclear power is reliable.

For a national, state or local utility, the appeal of nuclear power starts with its reliability. Regions with nuclear power plants deploy reactors around the clock, using nuclear as the baseload power source for electric grids. All other power sources depend on less reliable inputs—whether that's fuels with volatile prices or natural conditions that are unpredictable and intermittent, like wind, solar and hydroelectric.

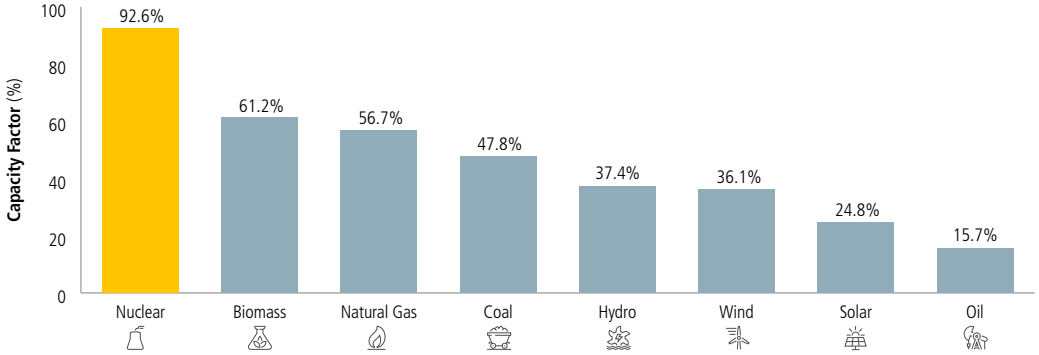
Building a nuclear power plant requires a major capital investment, but the cost of fuel is a minuscule share of the overall operating expense. For utilities, that means it's economically appealing to maximize their return on investment by running reactors at the highest possible capacity.

Apples to Apples: Comparing Capacity Factors

The capacity factor is a way of measuring energy output relative to the installed infrastructure.

Capacity factor = Actual units of energy produced/maximum potential units. A capacity factor of 100% would mean that a plant was producing all the energy it physically could around the clock. Nuclear energy has an incredibly high capacity factor of more than 90%.

Figure 4. Nuclear Energy Provides the Most Reliable Baseload



Note: Capacity factor measures the total amount of energy produced during a period of time divided by the amount of energy the plant would have produced at full capacity.
Source: U.S. Energy Information Administration and energy.gov. Data as of 12/31/2022. Included for illustrative purposes only. Past performance is no guarantee of future results.

Nuclear power plants have advanced in recent decades and the technology has evolved so that plants operate and maintain reactors more efficiently. This translates to fewer, shorter disruptions in the reactors' consistent production of electrical power.

These reliability dynamics mean that nuclear energy has an incredibly high capacity factor of more than 90%. The next most reliable source is biomass (plant-based material used as fuel, such as wood, soy and corn), which produces 61% of its potential energy capacity. Renewables such as wind and solar rank relatively low given that they are intermittent and subject to fluctuating wind and solar conditions. They are among the least reliable sources for meeting electricity demand. Hydroelectric power is greatly dependent on water flow and has been negatively impacted by increased drought conditions due to climate change. For these three renewable sources, variable weather patterns can greatly impact electricity production, leading to potential shortfalls.

2. Nuclear power is efficient.

One uranium fuel pellet—about the size of a gummy bear—is the energy equivalent of three barrels of oil, one ton of coal or 17,000 cubic feet of natural gas, according to the American Nuclear Association, as shown in Figure 5. The size and weight advantage of nuclear fuel adds up when considering the full life cycle of energy production—extraction, refining, transport, production and especially waste disposal.

At each step, the energy density of uranium translates to large efficiencies. Efforts to reprocess or recycle spent fuel in nuclear power plants extend uranium's efficiency further. Enriched uranium uses only about 4% of the potential energy in the first cycle through a reactor. As the technology advances to make it more economically viable to recycle fuel, the efficiency of nuclear is likely to rise even higher.

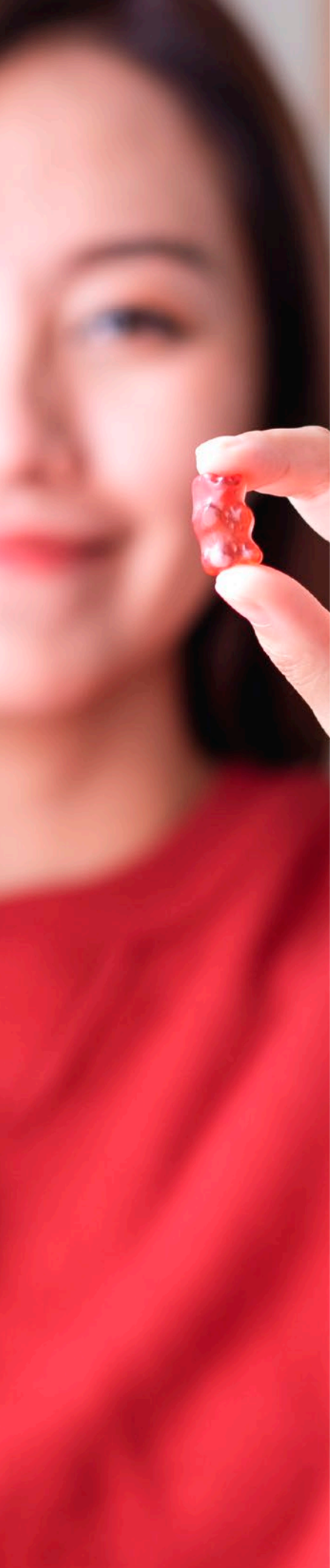
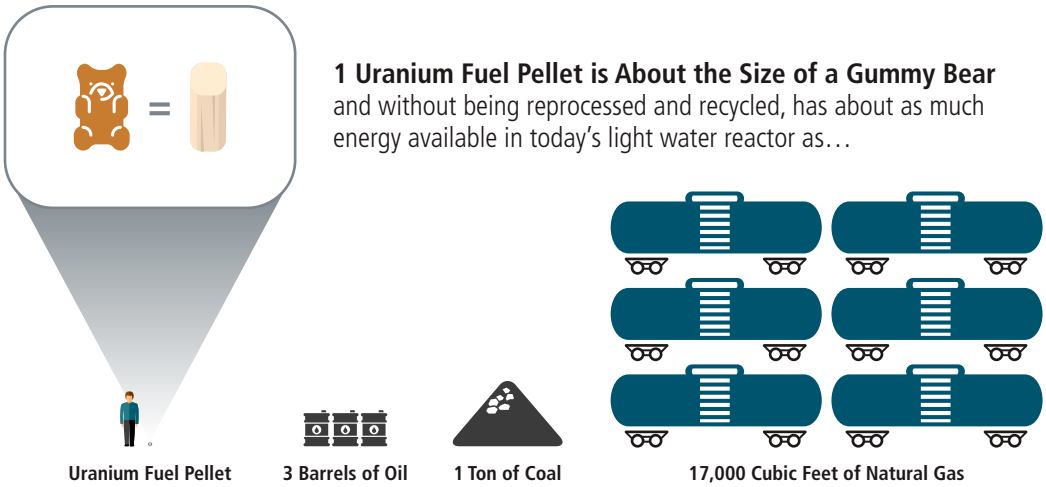


Figure 5. Nuclear Fuel Is Efficient



Source: American Nuclear Association. Included for illustrative purposes only.

Spent nuclear fuel even has arguable appeal. Compared to the waste byproducts of other energy production processes, nuclear fuel has two significant advantages. First, the waste is physically compact. The waste from a reactor supplying one person's electricity needs for a year is about the size of a brick. Only five grams[6] of this is high-level waste (the type requiring the most shielding from radiation).

Second, and even more important, the waste from nuclear power is completely accounted for in the cycle. Fossil fuel energy creates expensive and destructive externalities for societies, most of which are invisible to the human eye. Fossil fuel plants are regulated for emissions, but they are not forced to bear the true costs of their wastes.

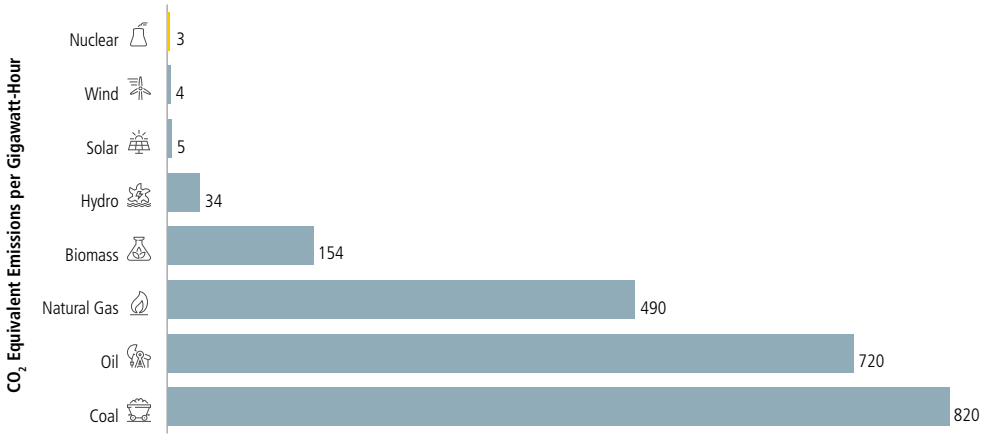
3. Nuclear power is clean.

Nuclear energy generates the lowest greenhouse gases of any power source, period. Over the full life cycle of nuclear power production, each gigawatt-hour of electricity contributes about three CO_2-equivalent emissions per gigawatt-hour of electricity, which is in line with wind and solar. Hydroelectric power sources generate 11 times more CO_2-equivalent emissions; oil and coal generate 240 and 273 times more, respectively.[7]

[6] Source: https://sprott.com/insights/special-uranium-report-key-facts-about-spent-nuclear-fuel/#.

[7] Source: ourworldindata.org; measured in emissions of CO_2-equivalent per gigawatt-hour of electricity over the life cycle of the power plant. Data as of 12/31/2020.

Figure 6. Nuclear Has the Lowest Full-Cycle Carbon Footprint



Source: https://ourworldindata.org/nuclear-energy as of 2021; measured in emissions of CO_2-equivalent per gigawatt-hour of electricity over the life cycle of the power plant. Included for illustrative purposes only. Past performance is no guarantee of future results.

4. Nuclear power is safe.

A common perception of nuclear energy is that it's unsafe because of the risk of leaking radiation from reactors or spent fuel—but it is scientifically a far safer energy production method than fossil fuel sources. The mortality rate for the nuclear energy cycle is 0.03 per TWh (terawatt-hour), which includes Chernobyl and Fukushima, which is in line with renewables and about 821 times safer than coal.

Nuclear Power's Low Mortality Rate

Nuclear power technology has not changed since it was first implemented in the mid-20th century, but the safety protocols have advanced significantly. The 1986 disaster at Chernobyl was driven by an insufficient reactor containment blamed on a flawed Soviet-era design and by avoidable operator mistakes. The international community upgraded design standards and safety protocols after the tragedy.

As shown in Figure 7, mortality rates reflect the damage to human life from both the extraction cycle and environmental effects. Energy from coal releases so much toxic pollution that it is estimated to account for 4,400 deaths per day in China, where coal plant usage is the highest.[8]

The secure storage of spent nuclear fuel (SNF) is the other key issue for nuclear power's safety ratings. SNF must be stored indefinitely because it is radioactive for hundreds of thousands of years—but importantly, the portion of the SNF that generates most of the penetrating heat and radiation has a short half-life. As a result, the radioactivity level of SNF decays exponentially.

[8] Source: http://berkeleyearth.org/wp-content/uploads/2015/08/China-Air-Quality-Paper-July-2015.pdf.

The Two Types of Radioactivity in Spent Nuclear Fuel

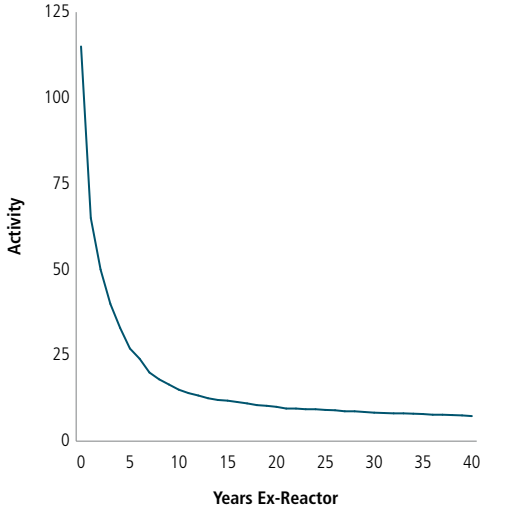
Spent fuel contains two different kinds of radioactive materials: certain lighter isotopes like cesium-137 and plutonium. The lighter isotopes account for most of the heat and penetrating radiation, but they decay relatively quickly, with a half-life of 30 years. Plutonium has a much longer half-life of 24,000 years, but it generates very little penetrating radiation.

Figure 7. Nuclear Operations and Waste Are Safe

Mortality Rate per TWh of Energy Produced†

Energy Source	Mortality Rate (per TWh)
Solar	0.02
Nuclear*	**0.03**
Wind	0.04
Hydro	1.3
Natural Gas	2.8
Biomass	4.6
Oil	18.4
Coal	24.6

Post Reactor Radiation Levels (years)††



Source: https://ourworldindata.org/nuclear-energy as of 2021. Included for illustrative purposes only.

* Death rate for nuclear energy includes deaths from Fukushima and Chernobyl disasters and the deaths from occupational accidents (largely mining and milling). Death rates from fossil fuels and biomass are based on state-of-the-art plants with pollution controls in Europe and are based on older models of the impacts of air pollution on health. This means these death rates are likely to be very conservative.

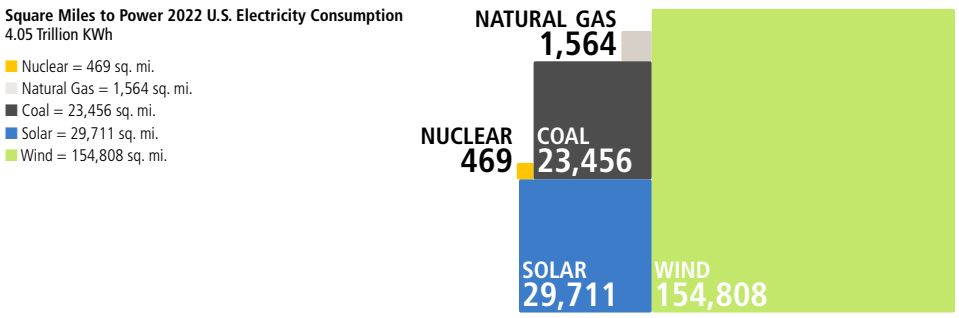
† Markandya & Wilkinson (2007) in The Lancet, and Sovacool et al. (2016) in Journal of Cleaner Production.

†† Radioactivity.eu.

5. Nuclear uses less land.

Nuclear energy, compared to other energy sources, uses the least land relative to the amount of electricity that it generates, and it's not even close. To add perspective, the United States consumed 4.05 trillion kilowatt-hours (KWh) in 2022. If 100% of that electricity were to be generated via nuclear energy, it would occupy only 469 square miles of land, as shown in Figure 8. When applying the same 100% of the national electricity scenario to other energy sources, natural gas would occupy more than three times as much land as nuclear energy, followed by coal, which would occupy 50 times the amount of land as nuclear, solar at 63 times, and finally wind at 330 times. Included in the 469 square miles that nuclear would need to power the country is the land for uranium mining, storing spent fuel and connecting to the electricity grid. Ultimately, nuclear power plants achieve high efficiency with little land usage due to its exceptional energy density, providing a significant advantage over other energy sources.

Figure 8. Nuclear Has the Lowest Land Footprint



Source: https://www.washingtonpost.com/climate-environment/interactive/2023/renewable-energy-land-use-wind-solar/ as of 5/10/2023. Included for illustrative purposes only.

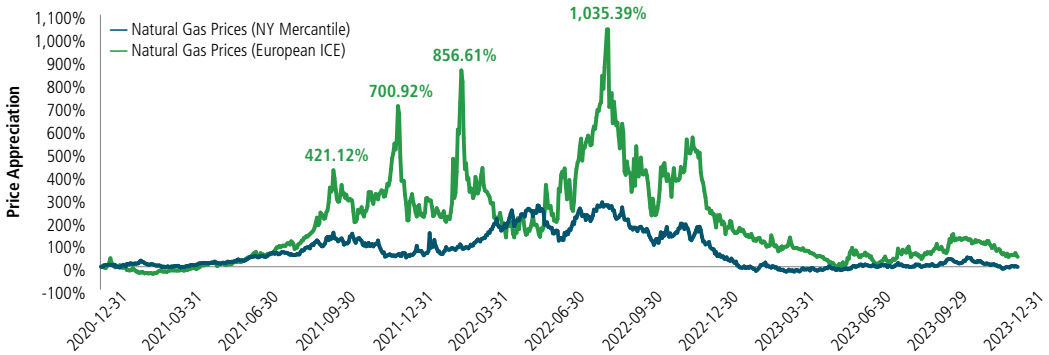
6. Nuclear power may offer greater energy security.

The Russia-Ukraine war has created a sense of urgency among Western nations to securitize energy sources. According to the International Energy Agency (IEA), natural gas imported from Russia accounted for around 45% of the EU's gas imports in 2021. Natural gas prices in Europe then soared compared to the U.S., putting significant pressure on policymakers to find more secure alternatives.

On March 3, 2022, the IEA released A 10-Point Plan to Reduce the European Union's Reliance on Natural Gas; one of its points recommends maximizing dispatchable low-emissions sources, including nuclear:

> "**Nuclear power is the largest source of low emissions electricity in the EU**, but several reactors were taken offline for maintenance and safety checks in 2021. Returning these reactors to safe operations in 2022, alongside the start of commercial operations for the completed reactor in Finland, can lead to EU nuclear power generation increasing by up to 20 TWh in 2022. A new round of reactor closures, however, would dent this recovery in output: four nuclear reactors are scheduled to shut down by the end of 2022, and another one in 2023. A temporary delay of these closures, conducted in a way that assures the plants' safe operation, could cut EU gas demand by almost 1 billion cubic meters per month."

Figure 9. Natural Gas Prices in the EU Have Soared (2020-2023)



Source: Bloomberg as of 12/31/2023. Natural Gas Prices (NY Mercantile) refers to NG1 comdty, U.S. Natural Gas prices. Natural Gas Prices (European ICE) reflects FN1 comdty, UK Natural Gas prices. You cannot invest directly in an index. Included for illustrative purposes only. Past performance is no guarantee of future results.

A New Uranium Bull Market[9] Underway?

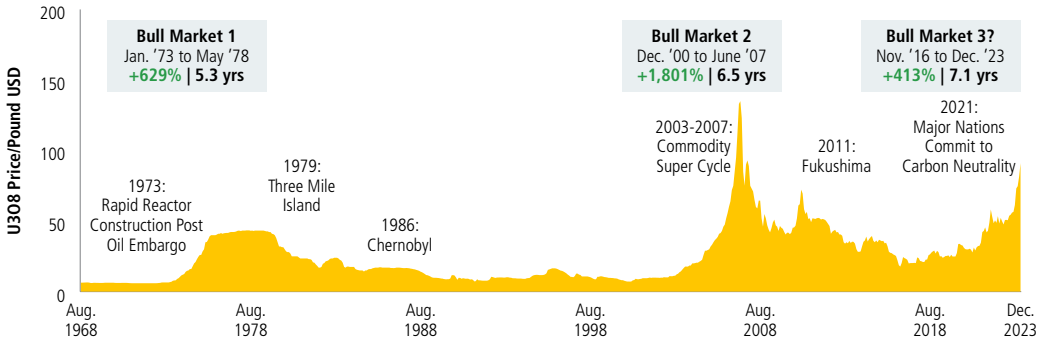
The changing sentiment toward nuclear power is one element driving the first signs of a new uranium bull market. Uranium has had two previous bull markets in the past seven decades. The first was during the energy crisis of the 1970s, a phase of history that prompted a major wave of investment in nuclear power plants. The dynamics of the era were complex. The raging Cold War prompted countries to stockpile uranium just as hundreds of new nuclear power plants were under construction. The resulting bull market for uranium ran from 1973 to about 1978.

Supply and demand stabilized in the 1980s. Despite a movement for nuclear disarmament, the continued Cold War drove countries to keep building reserves of uranium. But higher uranium prices had prompted mining activity. Uranium traded in a fairly consistent range until around 2003, when an inflationary supercycle drove many commodities sharply higher through 2007. Markets also traded higher on a trending view that nuclear energy was soon facing a renaissance just as secondary supplies (i.e., defense stockpiles) were tapping out.[10]

The 2000-2007 bull market ended with the Global Financial Crisis (2008-2010) and was further reinforced by negative sentiment after the 2011 tsunami-driven accident at Fukushima.

Today, we believe that we are in the midst of a third bull market that has been building since 2016. The climate change movement set in action by the Paris Agreement has helped drive the uranium spot price[11] up from its price lows in 2016.

Figure 10. New Uranium Bull Market in Development? (1968-2023)



Source: TradeTech LLC as of 12/31/2023. Included for illustrative purposes only. Past performance is no guarantee of future results.

[9] A "bull market" is the condition of a financial market in which prices are rising or are expected to rise. The term "bull market" is most often used to refer to the stock market but can be applied to anything that is traded, such as bonds, real estate, currencies and commodities. (Source: Investopedia.)

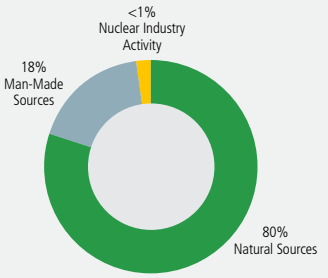
[10] Source: https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/uranium-resources/supply-of-uranium.aspx.

[11] The spot price is the current price in the marketplace at which a given asset—such as a security, commodity or currency—can be bought or sold for immediate delivery.

Understanding Nuclear Radiation

Nuclear radiation exposure is minimal compared to the many sources of radiation we could come across in our daily lives.

Approximately 80 percent of an average person's annual radiation exposure comes from natural sources, such as sunlight, soil and water, while ~18% comes from man-made sources such as computers, cell phones and X-rays. Less than 1% comes from the nuclear industry, including uranium exploration and mining.



Source: U3O8 Corporation. May not add up to 100% due to rounding.

Measuring Radiation Exposure

Far less radiation stems from nuclear energy than from activities not commonly associated with nuclear activities, such as flying on an airplane or interacting with more traditional energy sources.

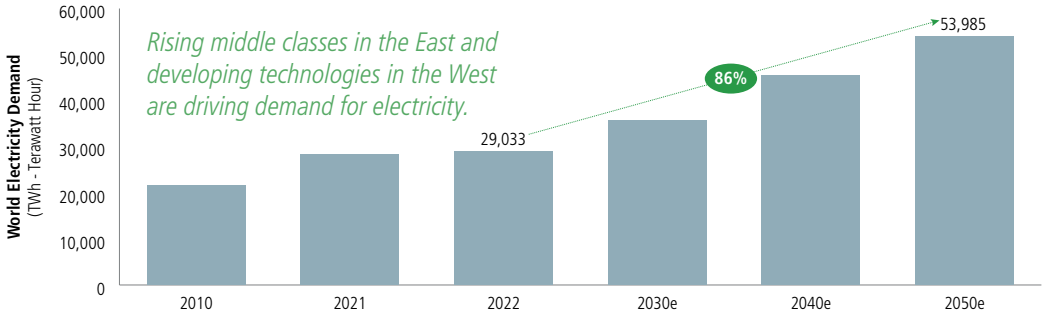
Millirems of Radiation (mrem)	
5,000	Annual U.S. regulatory radiation limit for an adult
500	One transcontinental round trip flight
360	Average person's annual exposure from all sources
20	Living one year outside a coal plant
2	Living one year outside a nuclear power plant

Source: U3O8 Corporation.

Uranium Demand Dynamics Are Boosting Spot Prices

Global demand for electricity is expected to climb 86% between 2022 and 2050, according to the IEA. In the developed world, much of this demand stems from technological innovation, such as a preference for electric vehicles and greater usage of electronics. In the developing world, tectonic demographic shifts are underway, driving higher incomes, population growth and the rise of middle classes, which translates into increased demand and consumption of new technologies.

Figure 11. Electricity Demand Estimated to Increase 86% by 2050



Source: IEA World Energy Outlook 2023 Stated Policies. Included for illustrative purposes only.

To meet these expectations, many nuclear power plants are currently under construction—but an even larger number are in the planning stage. Today, there are 437 nuclear power reactors in operation; 61 are currently in construction, primarily in China and across Europe and the Middle East, while another 113 reactors are planned for construction, as shown in Figure 12.

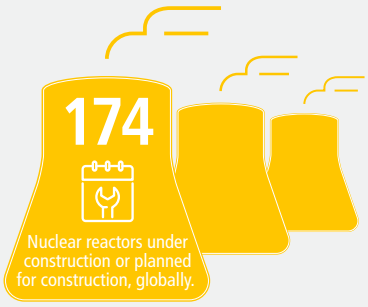
In terms of capacity and uranium usage, it's also important to remember that many first- and second-generation reactors from the 1950s through the 1980s are smaller units producing around 400 to 500 megawatts of electricity (MWe). New reactors tend to be 1,000 or more MWe in capacity.

Uranium Miners Are Poised for Growth

Today, the post-Cold War uranium stockpiles are gone, many mines have been closed and new supplies aren't keeping up with demand:

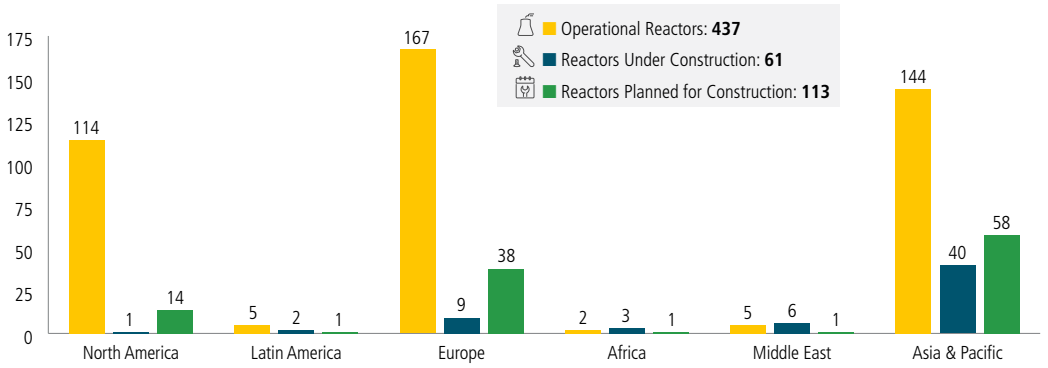
- The number of nuclear reactors is set to increase by 40% in the coming years.
- As of January 2024, 174 new reactors are under construction or planned for construction.
- Existing and committed uranium mines at historic production capabilities are not forecast to meet reactor demand to 2040.

† Source: UxC, LLC. Data as of Q4 2023.



Source: World Nuclear Association as of 1/10/2024. Included for illustrative purposes only.

Figure 12. Nuclear Reactors in the World Today



	Operational	Under Construction	Planned
North America	114	1	14
Latin America	5	2	1
Europe	167	9	38
Africa	2	3	1
Middle East	5	6	1
Asia & Pacific	144	40	58
Total	**437**	**61**	**113**

Source: World Nuclear Association as of 1/10/2024. Included for illustrative purposes only.

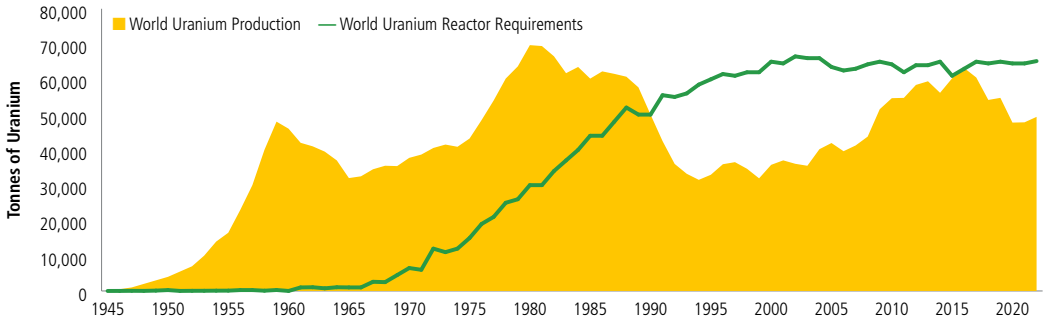
Uranium Supply Dynamics Stand Supportive of a Continued Bull Market

Global production of uranium has not kept pace with reactor requirements. Until recently, the production gap has had little effect on spot prices. In the Cold War era, countries were actively accumulating uranium for defense readiness. However, since the end of the Cold War in 1989, uranium demand has been limited to nuclear power production.

In the de-escalation era that followed the end of the Cold War, enriched uranium supplies reserved for weapons were released for use in power plants. This supplied nuclear power plants for many years. In 2002, only 54% of power plant uranium came from mining activity, with the remainder coming from secondary supply. Utilities worked through the excess supply. By 2012, 95% of power plant uranium was supplied by mining.[12]

[12] Source: https://www.oecd-nea.org/jcms/pl_13870.

Figure 13. Production Will Matter Now That Cold War Stockpiles of Uranium Are Depleted (1945-2022)



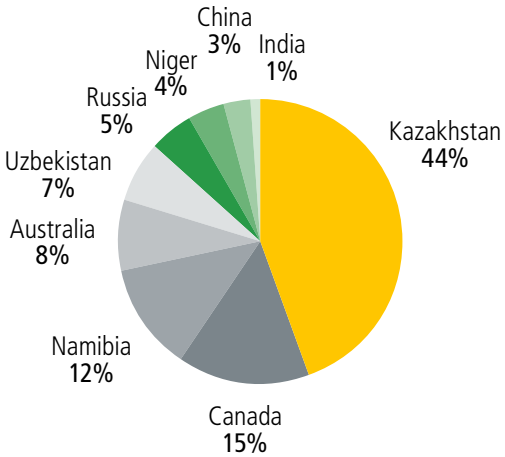
Source: OECD-NEA/IAEA, World Nuclear Association as of 12/31/2022. Included for illustrative purposes only. Past performance is no guarantee of future results.

Uranium mining did pick up in the 2010s, but it remains below the level of current reactor demand by millions of pounds annually, and is likely to persist. In recent years, new supply dynamics have further challenged the market's ability to meet demand. The Russian invasion of Ukraine has led Western utilities to self-sanction; they are taking deliveries of uranium under current contracts, but are not signing any new contracts.

Legislation like the Prohibiting Russian Uranium Imports Act in the U.S. would further limit dependency on Russia. The 2023 Nigerien coup d'état has also raised concerns about the security of supply. It is worth noting that roughly half of the total uranium production in 2022 came from Kazakhstan and was shipped through Russia.

Figure 14. Largest Uranium-Producing Countries

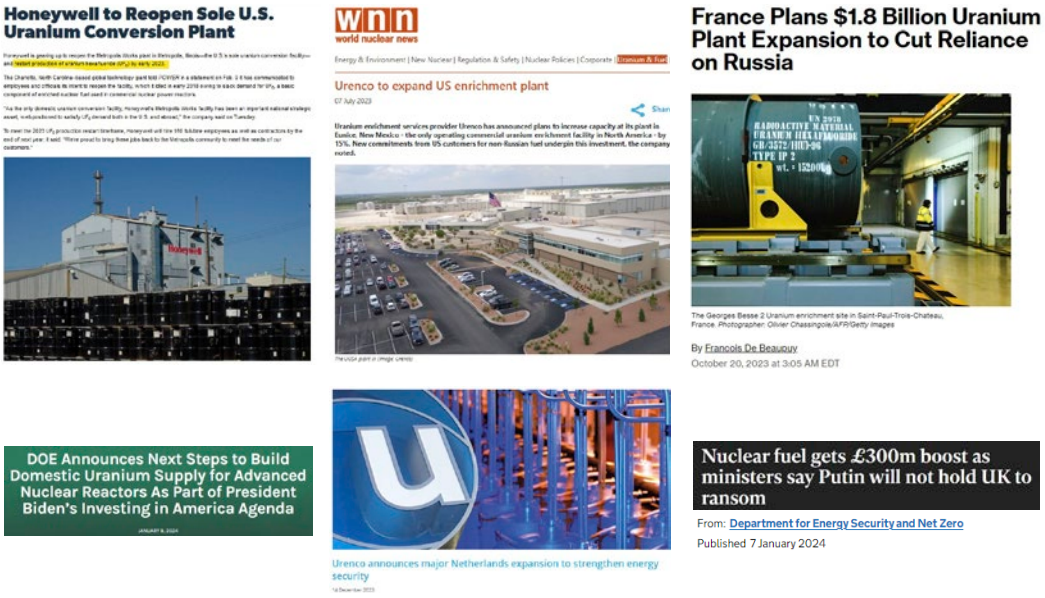
Roughly half of the total uranium production in 2022 came from Kazakhstan and was shipped through Russia.



Source: World Nuclear Association as of 12/31/2022. Included for illustrative purposes only. Past performance is no guarantee of future results.

Further, for supply to meet demand in the 2020s, the industry has had to rely more and more on secondary supplies. One such source of secondary supplies has been underfeeding in the uranium enrichment process. Historically, when enrichers had surplus capacity, they introduced a reduced quantity of uranium into the enrichment centrifuges over an extended duration—a method termed "underfeeding". Essentially, the enrichers used less uranium than typically required. Notably, Russia controls 39% of this enrichment capacity, as cited by the World Nuclear Association. With potential sanctions looming on Russian enrichment services or Russia itself restricting enrichment access, there's a growing demand for Western enrichment services. This shift could reverse the trend, transitioning from underfeeding to overfeeding, wherein enrichment centrifuges receive a larger uranium input. Such a pivot in the industry would boost uranium consumption, tilting the balance from supply to demand.

Figure 15. Reshoring of Western Nuclear Fuel Supply Chain Underway



Though underfeeding has helped provide additional supply to the market, commercial inventories have been the dominant source of secondary supplies in recent years. This grew significantly and peaked in 2021, but still with larger than historical inventory drawdown/ sales in 2022 and 2023. Today in 2024, we firmly believe that the available-for-sale inventory has been sold and that the era of inventory destocking is over.

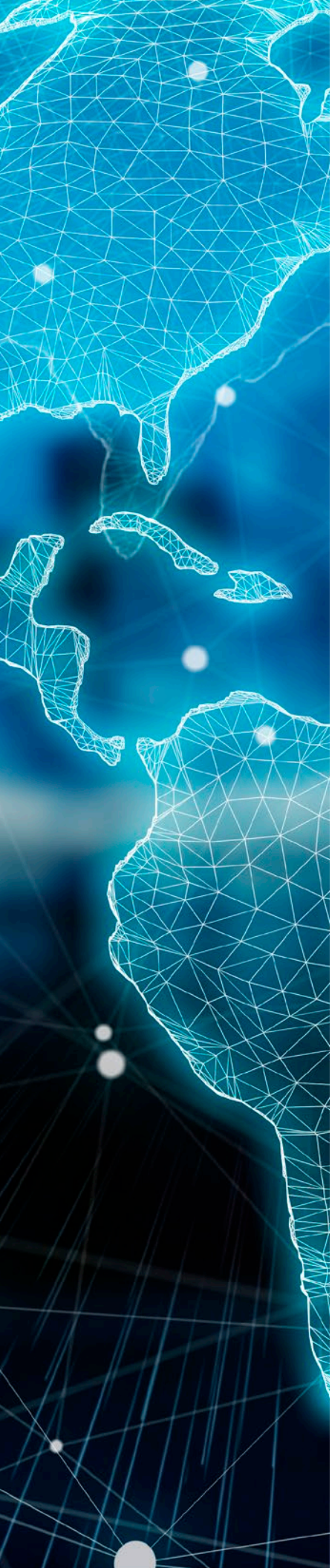
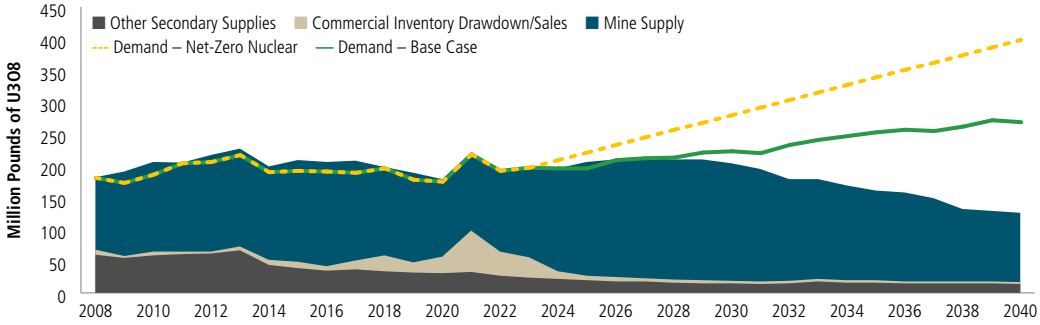


Figure 16. Uranium Supply and Demand Imbalance May Likely Grow



Sources: UxC, LLC and Cameco Corp. Data as of Q4 2023. Included for illustrative purposes only.

Increased focus on decarbonization and energy security has further shifted nuclear energy policies and government support, and at COP28 (the annual United Nations climate change conference) there was "the greatest outpouring of global support for nuclear power the world has seen since the thunderous reception to Eisenhower's Atoms for Peace call exactly 70 years ago", said Seth Grae, President and CEO of Lightbridge Corporation. To this end, 22 countries pledged to triple global nuclear energy capacity by 2050. The Net-Zero Nuclear Industry Pledge would increase the deficit to 2.2 billion pounds.

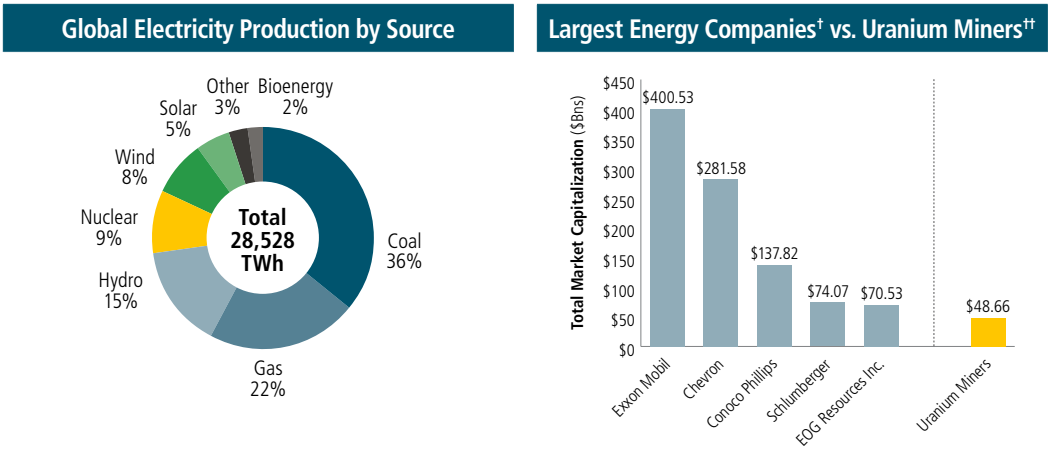
Uranium Miners Stand Poised for Growth

In our view, the prevailing backdrop bodes well for uranium miners. We see these trends driving upside for miners in the years to come:

As nuclear power takes share, uranium miners may grow.

Globally, nuclear power represents only about 9% of electricity production today and more than 25% of low-carbon emissions electricity.[13] As we noted earlier, renewable energy sources have added to electricity production to date; they have not replaced carbon-emitting production. Nuclear power is a clear frontrunner for replacing fossil fuel sources over time. Renewables have become much more competitive in cost, but they do not have the dependable capacity to take a significant share of the broader energy market.

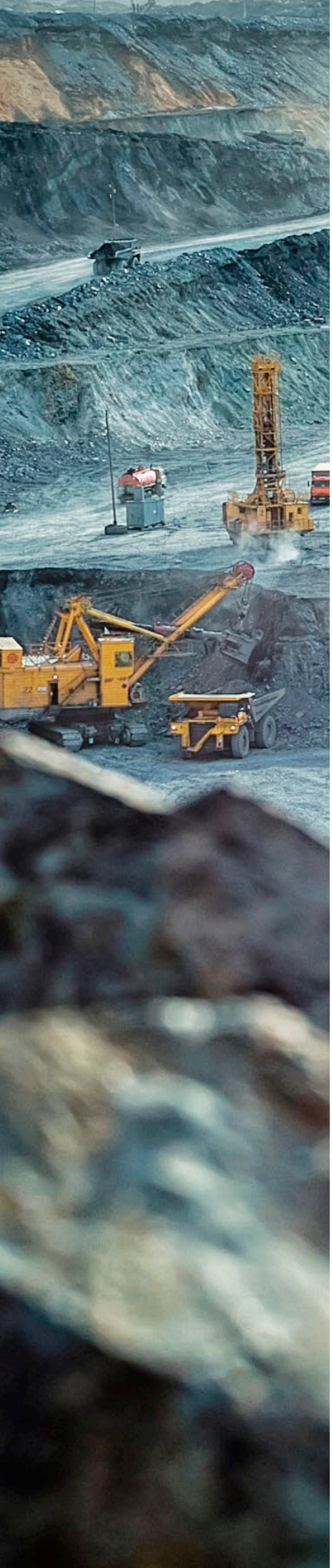
Figure 17. Miners Represent a Small Share of Energy Players Today



† Reflects the top five largest holdings by market capitalization in the SPDR Select Sector Energy ETF (NYSE: XLE) as of 12/31/2023.
†† Source: Bloomberg as of 12/31/2023. Reflects equities classified by Sprott Asset Management.
Included for illustrative purposes only. Past performance is no guarantee of future results.

As nuclear power gains a greater share of the worldwide energy market, the balance of capital across energy market names may also shift. Today, uranium miners represent just a tiny fraction of the market capitalization of all energy companies. Single-company oil and gas conglomerates remain vastly larger than the entire uranium equity sector, in keeping with the relative share of their products in the electricity market.

[13] Ember for full year 2022.



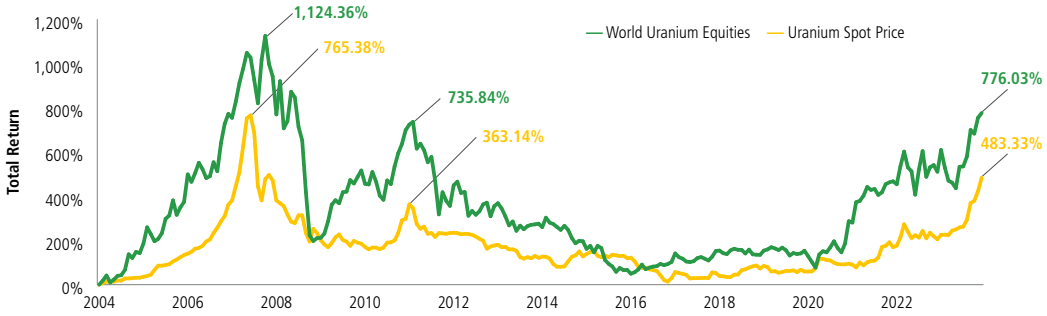
Higher spot prices prompt mining activity.

Another way to consider the equity value of miners is in the outlook for mining activity. Uranium miners will be critical in meeting the supply-demand gap referenced earlier. The U3O8 spot price is currently above $100 per pound and is allowing miners to restart projects and develop new ones. Uranium juniors also stand to benefit from potential mergers and acquisitions, as their future production has not been already contracted for, as opposed to well established producers. Producing uranium miners may be poised to generate higher revenues and potential profits if and when mining production ramps up.

Uranium miners may have investment torque to underlying spot prices.

Historically, the value of uranium miners is leveraged to the underlying price of uranium. Put another way, miners tend to outperform during physical uranium bull markets. Our outlook for uranium spot prices remains bullish for several reasons, both demand- and supply-driven, as we have discussed throughout this white paper.

Figure 18. Mining Equities Historically Outperform During Uranium Bull Markets (2004-2023)



Source: Bloomberg and TradeTech LLC. Data from 1/1/2004 to 12/31/2023 reflecting longest available data. World Uranium Equities measured by the URAX Index, which tracks the performance of stocks globally that conduct business with uranium. URAX and Uranium Spot denominated in U.S. dollars. You cannot invest directly in an index. Included for illustrative purposes only. Past performance is no guarantee of future results.

IMPORTANT DEFINITIONS

Bull Market: A condition of financial markets where prices are generally rising.
Spot Market: Where financial instruments, such as commodities, are traded for immediate delivery.
Spot Price: The price where a financial instrument, such as commodities, would be traded for immediate delivery.

Appendices

Appendix A

The Uranium Life Cycle

Source: World Nuclear Association. Included for illustrative purposes only.

Appendix B

Global Policy Initiatives Support Nuclear Energy

Global governments are recognizing nuclear power's vital role as a carbon-free energy source.

United States

- U.S. Department of Energy has requested $4.3 billion to assist in transition away from Russian sources of uranium
- Climate and energy provisions of Inflation Reduction Act commit $370 billion toward clean energy
- U.S. climate & energy bill to provide $15/MWh tax credit for existing reactors
- Biden's infrastructure bill supports nuclear:
  - $6 billion to support at-risk nuclear power plants
  - Funding secured for $3.5 billion of advanced nuclear power

European Union (EU)

- United Kingdom new energy security policy includes 16 gigawatts of nuclear energy
- Netherlands earmarks €5 billion for new nuclear support by 2030
- Finland's Green Party openly supports nuclear power
- Reactor life extensions in Czech Republic, Sweden, Belgium and Finland announced
- France approved €52 billion construction of six new reactors
- Polish government has approved its first nuclear power plant

Did You Know?

- Arizona is home to the largest U.S. nuclear power plant
- Japan is home to the world's largest nuclear power plant
- 80% of an average person's radiation comes from natural sources (e.g., sunlight, soil, rocks, water, plants, animals and our own bodies)

"Nuclear power helps the U.S. avoid 470 million metric tons of carbon in the atmosphere each year, the equivalent of an additional 100 million cars on the road."

China

- Planning to grow to 400 gigawatts (accounting for 18% of electricity) by 2060, more than the current global fleet of nuclear plants
- China has ambitious plans with 26 reactors under construction, 42 planned and 154 reactors proposed

Japan/South Korea

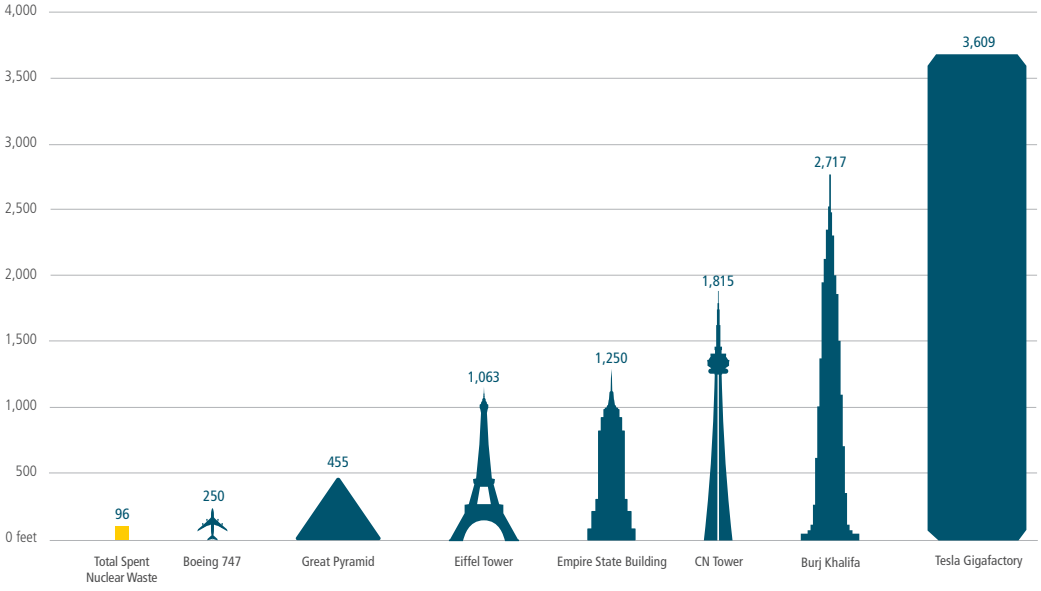
- Japan has restarted 11 reactors and another 16 are at various stages in the process of restart approval
- Japan plans to generate 20-22% of its electricity from reactors by 2030
- South Korea made a full reversal of its nuclear phase-out policy and expanded its program

Sources: World Nuclear News; Bloomberg; Sprott Asset Management LP; WMC Energy.

Appendix C

Total Spent Nuclear Waste

- If all the nuclear waste from commercial reactors, a 63-year operating history, were stored in a cube, it would measure just 96 feet per side
- Nuclear waste produces the smallest amount generated by any source of energy when considered on an "all-in" basis

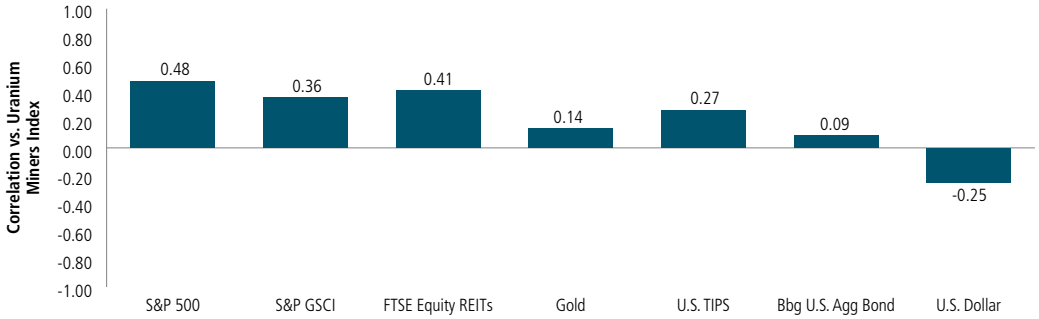


Source: NukeReport. Nuclear Asia as of 10/30/2020. Included for illustrative purposes only.

Appendix D

Uranium Miners Have Offered Diversification

Uranium miners have exhibited a low/moderate correlation to major asset classes, posing potential diversification benefits.



Diversification does not eliminate the risk of experiencing investment losses. You cannot invest directly in an index. Included for illustrative purposes only. Past performance is no guarantee of future results. Uranium Equity Index reflects The World Uranium Total Return Index (URAX Index); S&P GSCI reflects the S&P GSCI Index (SPGSCI Index); S&P 500 reflects the S&P 500 Index (SPX Index); Bbg U.S. Agg Bond reflects the Bloomberg Barclays U.S. Aggregate Bond Index (LBUSTRUU Index); FTSE Equity REITs reflects the FTSE NAREIT Equity Index (FNRE Index); Gold reflects the Gold Spot Price (GOLDS Comdty); U.S. TIPS reflects the Bloomberg Barclays U.S. Treasury Inflation-Notes Index (LBUTTRUU Index); U.S. Dollar reflects the U.S. Dollar Spot Index (DXY Curncy).

Source: Bloomberg. Monthly data from 6/30/2017 to 12/31/2023.

"**Why Do We Fear Nuclear Power?** Fear of power in any form, and those who wield it, is quite deep in the human psyche....with the dropping of the first atomic bomb on Japan, nuclear power came to be associated with the dark side of power technology."
– Source: Forbes. "Why Are We So Afraid of Nuclear?" James Conca, May 24, 2013.

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The Funds will be concentrated in the gold and silver mining industry. As a result, the Funds will be sensitive to changes in, and its performance will depend to a greater extent on, the overall condition of the gold and silver mining industry. Also, gold and silver mining companies are highly dependent on the price of gold and silver bullion. These prices may fluctuate substantially over short periods of time so the Fund's Share price may be more volatile than other types of investments.

Funds that emphasize investments in small/mid-cap companies will generally experience greater price volatility.

Funds investing in foreign and emerging markets will also generally experience greater price volatility.

There are risks involved with investing in ETFs, including the loss of money.

Diversification does not eliminate the risk of experiencing investment losses.

The market for gold/precious metals is relatively limited; the sources of gold/precious metals are concentrated in countries that have the potential for instability; and the market for gold/precious metals is unregulated. The Fund may also invest in foreign securities, which are subject to special risks including: differences in accounting methods; the value of foreign currencies may decline relative to the U.S. dollar; a foreign government may expropriate the Fund's assets; and political, social or economic instability in a foreign country in which the Fund invests may cause the value of the Fund's investments to decline. The Fund is non-diversified, meaning it may concentrate its assets in fewer individual holdings than a diversified fund. Therefore, the Fund is more exposed to individual stock volatility than a diversified fund.

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