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Uranium 102: Demand

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Daren: Welcome to the second edition of the Azarias Capital Management uranium podcast series. Azarias Capital specializes in turnaround opportunities in the small-cap value universe, and that turnaround focus often leads us to industries poised for a cyclical upturn. Uranium is a commodity, and like all commodities its price will be determined by supply and demand dynamics. Today we will take a deeper dive into the demand side of that equation. I'm Daren Heitman, the founder of Azarias Capital, and I'm joined by my colleague and partner, Chris Gillespie. Hey, Chris.

Chris: Hey, how're you doing?

Daren: I'm good, thanks. How are you doing?

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Chris: Good.

Daren: Excellent. Are you ready to talk some uranium demand?

Chris: I am.

Daren: I thought it would be helpful if we provided some context for demand, and so I thought maybe I'd just start with some basic history. So, uranium; we know it was developed as a weapon initially in the 1940s to end World War Two, and then from there they realized they could harness the power of splitting an atom to provide electricity. The basic science behind it is they use the heat that is produced from splitting an atom to boil water and turns a turbine and produces electricity. And so, the world really thought that they might have the solution for mankind's electricity needs, energy needs, for all time. And that might be a bit of an exaggeration but the world, and particularly the United States, embarked on building out a fleet of nuclear reactors to produce electricity in the 1950s, and that was a really strong growth market from the 1950s all the up through the early 80s. And then a number of events transpired to cause the industry to plateau, as measured by the number of nuclear reactors in operation beyond the mid-eighties and all the way

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through 2010. And one of those events was obviously Three Mile Island—if you're my age and Chris's age you vaguely remember that—and it really turned off the public to the benefits of nuclear power. And then in 1986 there was Chernobyl, although that was less of a real-time impact because people weren't really aware of what happened until year later. But nevertheless, the public turned against nuclear power and that's the reason that the number of nuclear reactors in operation really plateaued for decades until about 2010 when the story gets worse, because in 2010 Japan experienced the tidal wave that caused a nuclear accident at a nuclear reactor named Fukushima, and as a result of that Japan closed down all of their nuclear reactors overnight. So, with that, that brings us up to 2011, and now I'm going to start asking Chris questions, our resident expert. So, Chris—

Chris: Alright.

Daren: Are you ready?

Chris: Yes.

Daren: Alright, so tell our listeners how many nuclear reactors there were in operation prior to Fukushima.

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Chris: Sure. So, in 2011 there were about four hundred and forty nuclear reactors in operation and about forty-five of those were in Japan, so when Japan closed down its entire fleet that was a ten percent decrease in the number of operating reactors and therefore about a ten percent decrease in demand for uranium, just overnight. And in addition, Germany, as a result of what happened at Fukushima, decided to close a number of their reactors as well, so that was a pretty big one-time hit to demand in 2011 just overnight as a result of that tidal wave.

Daren: Yeah, it was a demand shock of ten percent, which no commodity could really withstand, and particularly uranium, and that's really the reason we've been in a bear market for the last ten years. But the good news is, going on ten years later, the nuclear reactors are actually back up to pre-Fukushima levels. Where did those incremental reactors come from? Was it simply a matter of Japan bringing their reactors back online?

Chris: Uh, no, Japan has been very slowly bringing their reactors back online. I think they got up to nine restarted but then they've actually closed a couple of those back down this year and last year. Of course, for security reasons, they're trying to make them more secure against potential terrorism, so they've only

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restarted, let's just say they've restarted nine, and then they probably only plan to restart somewhere in the neighborhood of twenty to twenty-five so, you know, only half of that's gonna come back. But where the new reactors builds have come from is: China has been a big builder of new nuclear reactors over the last several years; we've seen new reactors coming on in places like India, Russia, a lot of Asia and Eastern Europe, developing-type countries, and so since 2015 new reactors completed per year have averaged about eight, eight per year since then, and that's the most since the end of the Cold War, since around 1990, ninety-one. So, very good growth in brand new reactors and that's got the fleet back up to right around where it was at the time of Fukushima in 2011.

Daren: That's one of the things that we like about this industry is that the outlook for growth is really pretty visible. There are currently fifty-five new reactors currently under construction, so those are very likely to get build. So, as a quick recap: pre-Fukushima we had around four hundred and forty nuclear reactors operating, then Fukushima occurred and that dropped down to around four hundred, and now ten years later we're back up to four hundred and forty with the outlook to add about eight per year for the next several years. So, for the first time in decades

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uranium demand is actually growing on a secular basis, so that's a really good backdrop for this commodity.

Chris: Yeah, that's right. And in fact, maybe one thing to mention here is that last September the World Nuclear Association came out with their estimates for demand growth for uranium for the next ten years, from 2019 through 2030, and they have growth now under all of their possible scenarios, which is the first time that's happened since, again, since about 1990. And then their growth projection per year is about two percent per year going forward, so that was pretty big news for a number of people who were not fully up to speed as to what's going on in uranium demand and new nuclear reactors being built.

Daren: Yeah, well let's go right to that, because being a citizen of the United States is one of the reasons why we were surprised when were surprised, when we first dove into this industry, that it actually had a reasonably good growth outlook. So, let's walk through where these nuclear reactors currently reside and stop on each country and talk about the dynamics.

Chris: Well, as you might expect the biggest economic power in the world has the most reactors and that would be the United States. There are almost a hundred reactors

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in the United States, and so annual demand for uranium for those reactors is in the high forties—forty-eight million pounds a year. The next highest would be France. France has I think fifty-seven reactors, supplies about seventy percent of France's electricity and that equals about somewhere in the—maybe twenty-five million pounds of uranium a year. So, twelve percent of uranium demand is out of France, twenty-five percent out of the US. And then in third place and rising quickly is China. China has about in the neighborhood of fifty reactors now and they are continuing to add at a rapid pace. In fact, last year they announced that they planned to start building six to eight new reactors a year through 2030. So, you know, at that pace they will become the second largest pretty quickly. And then they have fifteen reactors under construction right now, in fact, out of the fifty-five. So, those are the three biggest, and then beyond that Japan was also large with, as we mentioned earlier, about forty-five. They're down to nine but they'll probably get back up into the twenties. It's a stated goal to have uranium be a big percentage of their electricity generation because they are without a lot of natural resources, so they're very dependent on energy imports and that's one way they can reduce that dependence. And then you get, you know, countries like Russia, and India, and Ukraine and places like

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that—Eastern Europe—but really it's all around the world you're seeing plants or new reactors in places that you might not expect like the Middle East, Saudi Arabia, et cetera. So, it's really a global phenomenon.

Daren: Right. So, I believe that most people, if you asked a man on the street, what they believe the outlook is for uranium, particularly in the United States, they would say it's a dying industry, probably like coal. What's our view of what's happening in the developed world, in the United States and France? Are plants closing?

Chris: Well, I guess maybe we could start with the US. There have been a number of announcements recently where nuclear operations said they were going to close their plants and after looking at that, the companies in consultation with the US states have actually decided to reverse those decisions. The most recent, that just happened a couple months ago in March in Pennsylvania, the Beaver Valley nuclear plant has two reactors and it was scheduled to shut down here in the next year, but they have now decided not to do that. And we've seen that in a number of States: Connecticut, New Jersey, Ohio, Illinois—all of these reactors that had been scheduled to close have gotten

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re-authorized and decided to stay open. And that's partly because--there was a plant in Connecticut that was gonna shut down and then they realized it was providing half of the state's energy and they didn't want to do that, so the company worked with the state and got a new deal and so, that's happening in the US. We've also seen in France, for example, when Macron came in and he sort of made an announcement that he was gonna reduce France's reliance on nuclear, reports since then have stated that he's kind of reevaluated that for the same reason; because it's a huge source of carbon-free, low-cost electricity. The same thing in South Korea: they made an announcement they were gonna close plants and now we're seeing them reversing that. In fact, they're actually building new plants in South Korea so, you know, one thing that's had a pretty big effect on that is Germany closing down their plants and then having to go and rely on more Co2 and more fossil fuels to provide their electricity. Other countries have looked at that and realized that nuclear is a very good source of no-Co2 energy. I read a recent study—in 2018 France and Germany had about the same amount of electricity generation but Germany had ten times the Co2 created comparative to France, and the primary reason is because France gets seventy percent of its electricity from nuclear, whereas Germany has had to go back in

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the direction a little bit to coal and also gas to replace the nuclear they closed down. So, you know, I think with people being more concerned about Co2, the existing plants are not shutting down. And it's also a driver in China—why are they adding so much new capacity? For the same reason: because it's low-cost once you put it in—it costs a lot to build, but once you put it in, it's low-cost, base-load power that doesn't generate a lot of pollution and that is an issue in China and in India, in a lot of other markets around the world.

Daren: Right. We built in some closures in more mature markets in our demand model of around two per year. But the outlook isn't nearly as dire as what conventional wisdom might believe, and if anything, the winds are starting to change, whether it's because of, as you mentioned, the role that nuclear power can play in reducing carbon emissions. But China probably doesn't really care that much about carbon emissions as far as it relates to Global Warming but they, like every other developing country over history, still want a cleaner environment for their population and better living conditions. And so that's definitely, in our opinion, driving their decision to continue to expand their fleet. But I guess back to the point of what's happening with the older fleet and what's

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happening in countries like the United States; there'll probably be some shrinkage, but it's happening so slowly that it doesn't disrupt our demand thesis, which calls for growth.

Chris: Yeah, that's right.

Daren: So, every plant that gets closed is going to be offset by five new builds, roughly.

Chris: Yeah. If you have, let's say, eight new ones a year and two or three closing a year, you're adding five or six on a net basis per year, which is a couple million pounds of uranium demand a year.

Daren: Right, on a base of around two hundred so that's where we get the one or two percent.

Chris: Right.

Daren: So, we just spent the first several minutes on talking about the number of nuclear reactors in operation, because in the end that is what drives demand for uranium, that these nuclear reactors consume a certain number of pounds per year. And so, what is that, Chris? How many—so, you have a nuclear

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reactor operating, it runs off of uranium, how many pounds does it consume on average?

Chris: You've got four hundred and thirty-five, four hundred and forty reactors right now. Each reactor consumes around, let's say, four hundred and twenty thousand pounds a year, and so the math on that is that gets you to about a hundred and eighty-five, a hundred and eight-six million pounds a year of demand. And then in addition to that, there are what's called first cores or initial cores, which is when you have to put the beginning core of uranium fuel into a reactor, and that number is about three times the annual consumption. So, you know, you have to put in about 1.2 million pounds in to start each reactor so, with eight new reactors a year that's another ten million pounds of demand on top of that demand in the high one-nineties, and then there's a couple million pounds of additional uranium demand for other uses. So, that gets you the two hundred million pound-a-year demand range.

Daren: Of consumption, I mean, so it's used up. So, one of the questions we get, what I've received over the last couple years talking about our thesis—Well, first of all, are there any substitutes for uranium? Could uranium be displaced by a different source of power?

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Chris: Not at this point, no, nothing that we know of.

Daren: That can be a short answer. I mean, if you have a nuclear reactor, it runs off of uranium and there is nothing on the horizon to suggest that they might be able to put a different fuel source in that nuclear reactor, at least for the next decade. Another question is: is there any risk that these nuclear reactors become more efficient? And so, instead of needing two hundred million pounds a year, maybe they could produce the same power with a hundred and fifty million pounds a year of consumption.

Chris: I think, you know, there were big improvements in efficiency throughout the, let's say the nineties into the 2000s, but the efficiency levels have seemed to have sort of plateaued here and flattened out over the last five to ten years. So, it does seem like they've figured out the ways to maximize production out of these reactors, but there hasn't been a lot of new increases in efficiency over the last several years.

Daren: And one of those efficiencies was simply capacity utilization, and that has a limit to how much better it can get. You can correct my exact numbers, but over the last several decades capacity utilization has gone

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from the high-seventies to the low-nineties, I believe. Do I have that right, Chris?

Chris: I think that's right for the US and for the world the numbers are a little lower, but yeah.

Daren: So, so far, we've talked about the existing fleet; we know that there are several nuclear reactors under construction, so the outlook for consumption is actually very visible. I guess we should talk about: what are the risks of global recession impacting demand? We know electricity demand goes down; it is somewhat economically sensitive—not as sensitive as other areas of the economy—but would a global recession impact the amount of uranium consumed in these nuclear reactors?

Chris: Very unlikely that it would have a large impact. We kind of went back and looked at the last four global recessions, we did the calculations, and the amount of electricity generated by nuclear power actually went up by about 2.2 percent during those recessions. So, we think that the demand for nuclear generation is actually much more tied to reactors under construction and then new reactors coming online. So, as we look at this recession being caused by the coronavirus, there are some unique elements that are causing demand for

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all energy sources to go down, but offsetting that for nuclear is that they're gonna be eight new reactors coming online, so that's—right off the bat you're having demand up by, let's say, one-and-a-half percent. Now some of the larger organizations that study global energy demand think that global energy demand is gonna be down fairly significantly this year, but nuclear will be down less than the overall number because, again, it's base-load power, and it's very cheap to run and so it's cheaper on a marginal basis, way cheaper than coal, cheaper than gas. So, we think generally in a recession nuclear is unlikely to go down. In this recession it's gonna go down a lot less than some of the other sources. We could definitely see it going down low single digits—two, three, four percent—this year, but that will be a much smaller decline than the other sources.

Daren: Right. And I don't want to steal the thunder of our next podcast, which will cover supply in greater detail, but even if we see consumption decline by a couple percent, supply is actually going down by more than a couple percent, so we don't see any risk to our thesis tied directly to this global pandemic. The flip side of having such a visible demand outlook, is that you don't really get a positive demand shock. There isn't much that can go wrong on the demand side,

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there's also not much that can go right. But longer-term, in addition to the new nuclear reactors, the large nuclear reactors that we know are in the pipeline, there's this technology called small modular reactors. So, I think it's worthwhile talking about what those are. Why are some countries trying to develop small modular reactors?

Chris: Yeah, those are a potential source of new demand. They are, as the name says, small, and they can be—you know, for example, Russia last year just implemented the first floating reactor so they now have a reactor that they can move on water to various cities in case something goes wrong with their power source and they need some power. So, I guess the idea is they're small, they're not that expensive, they don't require a big upfront capital investment, but they can actually make, they can produce a lot of power because nuclear provides a lot of bang for the buck. So, it could have a number of different uses; you know, military, industrial applications like mining, and also power for undeveloped areas of the world. We can kind of go in there and without a lot of big upfront cost you can provide a lot of power, and throughout history the ability to provide electricity to places has been hugely positive for economies and the people who get that electricity everywhere. But that's a

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scenario that people are excited about. It's probably still a few years out, but Russia did the floating reactor last year, I know the US military has some plans to try to accelerate developments of small reactors for their use as well, so it's something to keep an eye on.

Daren: Yeah, they—currently there's a big push to make that happen, and I think it's more likely than not that it will, because not just government but private industry is really seeing the benefits of that and it seems like there's a roadmap to bring that technology to the market in an economical way definitely within the decade if not in the next five or six years. Now these are small, so they're a fraction of the size and also a fraction of the cost of one of the large current reactors that are in operation. So, any one modular reactor isn't going to consume a lot of uranium, but if it works out the way that it could, there'll be potentially thousands of them around the globe and could actually be a meaningful incremental source of demand longer-term. But definitely beyond our time-horizon; we expect this supply deficit to play out in the next few years and hopefully we'll be moving on to our next investment thesis, but it's still an interesting source of incremental demand long-term. So, thank you, Chris, I really appreciate your

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thoughts. So, thank you for your time and I look forward to the next podcast in our series, where we'll do something similar on the supply side.

Chris: Always a pleasure. Thank you, Daren.

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