

NUCLEAR INTELLIGENCE WEEKLY[®]

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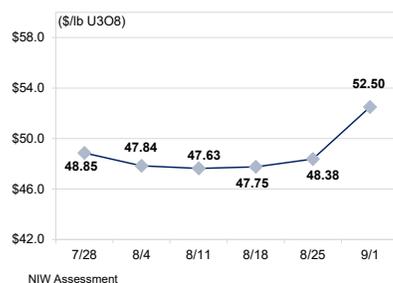
Market Points

Last week's news of Japan's plans for reactor restarts helped Sprott Asset Management's physical uranium trust raise \$24.5 million early this week.

Boosted by investor sentiment, Energy Intelligence's Uranium Price Panel delivered an average spot price of \$52.50 per pound U3O8 on Sep. 1, a 12% increase from Aug. 25.

The price rally that drove Sprott shares into a premium may have also helped a trader ahead of delivery into a market-linked contract to a utility.

UPP: \$52.50/LB U3O8



WEEKLY ROUNDUP

IAEA to Maintain 'Permanent Presence' at Zaporozhye

- The International Atomic Energy Agency (IAEA) is planning on a “permanent presence” at the Zaporozhye nuclear plant in Ukraine after a large team of inspectors, lead by Director General Rafael Grossi, conducted an hours-long visit to the site on Thursday. Immediately after returning to Vienna on Friday evening, Grossi described “latent tension” between Russian and Ukrainian operators, and said that despite requests he was unable to meet with any Russian military personnel on site. His biggest concern remains the plant’s physical integrity, given the “statistical probability” of more damage to the plant and evidence of recent shelling. The “way to cripple” the plant is to “hit where it hurts” — namely by cutting off the power supply. Six IAEA personnel remain at the plant, with four expected to return sometime next week and two remaining to provide “stability” at the plant. Grossi said he will be providing a more comprehensive report on the situation to the UN Security Council on Tuesday.
- The Tenth Review Conference (RevCon) of the Non-Proliferation Treaty (NPT) ended without agreement Aug. 26, with Russia unwilling to accept language in a draft final document related to its invasion and occupation of Ukraine’s Zaporozhye nuclear plant and Chernobyl. But consensus on a final document aimed at strengthening the treaty’s implementation had already been difficult, given the refusal of nuclear weapons states to agree on timelines, benchmarks and accountability for nuclear disarmament. Arab diplomats were described by one delegate as “privately incensed” at Egypt’s unexpected sign-off on “a very weak and essentially useless text” to establish a Middle East nuclear-weapon-free zone “that lacked any call on Israel to give up its nuclear weapons” — viewed as a “sellout by Egypt to the US.” The lack of progress on disarmament elicited a damning tweet from former IAEA Director General Mohamed ElBaradei: “The ugly truth no matter how we wrap it is that all nine nuclear weapon states have no intention to disarm; quite to the contrary the trajectory is towards more sophisticated ‘usable’ weapons and delivery systems!”
- The California legislature this week voted overwhelmingly to provide Pacific Gas & Electric’s 2,256 MW Diablo Canyon nuclear plant a \$1.4 billion forgivable loan to keep the plant operating until 2030, five years after its planned shutdown. The vote essentially repeals a 2018 law codifying a joint proposal with the plant’s workforce, neighboring communities, and environmental groups to close the plant by 2025. PG&E has already paid out more than \$300 million as part of the 2016 agreement’s precedent-setting “just transition” program. Part of the now-repealed law was the result of the plant’s inability to comply with state marine life standards without costly upgrades. The new legislation exempts the plant from such standards so it can continue operating and fill a projected supply gap of 1,800 MW, attributed to delays in bringing renewables online. The loan, proposed by Gov. Gavin Newsom’s office last month, could potentially be repaid using funds awarded by the US Department of Energy’s \$6 billion Civil Nuclear Credit program, for which Diablo Canyon is currently the only eligible candidate.

NUCLEAR FUEL MARKET

Investors Weigh Impact of Japanese Restarts

The uranium spot price jumped this week driven largely by investor sentiment after last week's news of Japan's plans for reactor restarts. That put the unit price of Sprott Asset Management's uranium fund at a premium and fueled a second week of fundraising, positioning Sprott to sequester another chunk of physical uranium from the market.

Besides investors at least one trader helped push the price higher. Energy Intelligence's Uranium Price Panel delivered an average spot price of \$52.50 per pound U3O8 on Sep. 1, up from \$48.38/lb. U3O8 on Aug. 25.

Earlier this week the price climbed to \$53.50/lb. but this rally on Aug. 29-30 may have also been aided by a trader ahead of market-linked delivery to a utility, according to sources. "Sprott at a premium and locked and loaded gave [the trader] an opportunity to push it higher," one market intermediary said. This was in addition to support linked to news last week from Japan's Ministry of Energy, Trade and Industry calling for the restart "around next summer or winter" of seven reactors, on top of the 10 currently operational.

Sprott Asset Management's physical uranium trust (SPUT) raised \$8.2 million on Aug. 30 and \$16.3 million on Aug. 29, to bring its total cash on hand to \$56.7 million. At current spot market levels, that means Sprott can procure another 1 million lbs. with the cash it has on hand. To date, Sprott has raised \$1.9 billion and procured 57.6 million lbs. of U3O8, with 200,000 lbs. U3O8 procured last week.

On Sep. 1, however, the uranium spot price shed about \$1/lb. of the more than \$4/lb. it gained since last week. That put Sprott's share price at a discount to its net asset value (NAV). Under the Canadian at-the-market offering rules, Sprott cannot sell shares when its share price dips below the fund's NAV.

That dip may have come after the dust settled on the Japanese restart news and uranium investors found themselves once more

in the middle of the nuclear fuel learning curve. Before Fukushima, the Japanese kept the bulk of their inventories as U3O8, but after the post-accident shutdown of Japanese reactors, they pushed delivery on conversion and enrichment contracts to allowable later dates. Today, the majority of the fleet's massive inventories of U3O8 have been converted to UF6 and either stored at conversion sites or enriched and delivered to fuel fabrication facilities.

"Japan actually presents a more bearish factor for uranium," and given that enrichment prices have more than doubled this year alone, "enriched uranium will have a FAR higher value than it was in the past," accountant Chapman Scarborough wrote in an Aug. 31 post in *Proven Reserves*, a uranium investment newsletter. Scarborough published translated data from a March 2022 report from Japan's Atomic Energy Commission showing Japanese utility inventories with 17,392 tons of enriched uranium product (EUP), which he estimates to be the equivalent of about 10 years of inventory based on 30 reactors operating.

The post caused a stir on Twitter and a fair amount of speculation and criticism from the swarm of hashtag uranium investors. But one Twitter user, Jeff Geringer, now a commercial director at Denison Mines and former fuel buyer at the Wolf Creek nuclear plant in Kansas, chimed in with one major caveat: "There is a lot of Japanese material on the books that has been loaned out into the market." Indeed, Energy Intelligence has previously reported estimates of up to 2,000 tU Japanese inventory loaned out to third parties.

"At some point this material needs to be returned to the Japanese utilities," Geringer continued, noting that much of it may already be loaded in non-Japanese reactors. "And so [Japanese] reactor restarts, in aggregate, put pressure on the date of those loan returns. Like the carry trade unwind, the future of #uranium is in debt to 'inventory raiding' of the past."

Jessica Sondgeroth, Washington

URANIUM PRICE PANEL

For the week ended September 1, 2022

	Weekly Spot Market Prices													
	Chg.	Sep 1	Sep 25	Aug 18	Aug 11	Aug 4	Aug 28	Aug 21	Aug 14	Aug 7	July 30	July 23	July 16	July 9
Price (\$/lb U3O8)	4.12	52.50	48.38	47.75	47.63	47.84	48.85	46.03	46.04	47.53	50.00	47.13	47.39	52.25
Total Assessments	-1.00	8.00	9.00	10.00	9.00	8.00	9.00	10.00	9.00	10.00	10.00	10.00	11.00	10.00
% within 1 StDev	-15.28	62.50	77.78	80.00	77.78	75.00	55.56	80.00	55.56	70.00	60.00	90.00	72.73	70.00
Low (\$/lb U3O8)	4.00	52.00	48.00	47.50	47.25	47.50	48.50	45.75	45.50	47.00	49.25	47.00	46.60	51.70
High (\$/lb U3O8)	4.50	53.50	49.00	48.25	48.00	48.25	49.25	46.25	46.75	48.50	50.75	47.50	48.50	52.50
Variability*	0.01	0.39	0.38	0.25	0.04	0.00	0.00	0.00	0.31	0.50	0.16	0.06	0.09	0.40

*This represents the value of the potential range of conceivable final averages that might result when random elimination is used to balance market positions within the panel.

POLAND

Warsaw's Divergent Goals Pursuing Large Reactors, SMRs

Poland's dual-track nuclear effort, seemingly divided between a government-backed push for new conventional reactors and an industry-backed effort for small modular reactors (SMRs), in fact reflects a government split over the best approach.

The "official" Polish nuclear program committed to delivering 6 to 9 gigawatts of nuclear capacity from large reactors has the imprimatur of the Council of Ministers, and is led by the Ministry of Climate and Environment. Separately, major Polish industrial firms have signed a number of memorandums with prospective SMR vendors. Crucially, however, these firms are parastatal companies majority-owned by the Polish Treasury, and overseen by the Ministry of State Assets.

SMR development is clearly further out in time than conventional newbuild so it's reasonable to ask whether these separate efforts can co-exist with carefully planned complementary, sequential development in which large reactors are launched first, followed by SMRs. Observers in Warsaw are dubious, and worry over clashing priorities and policy muddles.

Before year's end, the government's official program calls for selection of the first of two three-unit plants from one of three competing technologies: the AP1000 offered by US-based Westinghouse and Bechtel; the EPR offered by France's EDF; or the APR1400 offered by Korea Hydro & Nuclear Power. Separately, a number of Polish industrial firms have signed nonbinding agreements with US-based SMR developers, including copper producer KGHM with NuScale, a tie-up of oil refiner Orlen and chemical giant Synthos with GE-Hitachi Nuclear Energy, and power utility Enea with newly launched Last Energy.

Most of these agreements were made after Poland's official new-build plan, which basically ruled out SMRs, was released in 2020. It argued that SMRs were embryonic and an unrealistic energy option before 2040. "To date, no [SMR] construction contracts have been concluded, and there is no complete design and implementation documentation (construction projects) that could be subject to verification," read the government's plan. "Therefore, at the present stage, it is not possible to reliably estimate the future costs of such facilities."

The Lure of SMRs

The definitive dismissal of SMRs is hard to reconcile with the technology's embrace by state-owned KGHM, Orlen and Enea. Not surprisingly a group of parliamentarians asked the government about this in a Jul. 20 letter to the prime minister, which demanded to know why the Ministry of State Assets had "established a separate nuclear program" that is "competing" with the official

program adopted by the Council of Ministers. The signers were led by Maciej Konieczny of the progressive Razem party.

Piotr Dziadzio, an undersecretary of state at the Ministry of Climate and Environment, answered in an Aug. 8 letter: While large reactors are "technologically proven, safe and available," Dziadzio said, Polish firms expressing an interest in SMRs are taking into account "access to emission-free energy at competitive costs compared to conventional energy sources." Therefore SMRs "have a different role to play" as "a supplement, built for specific applications," for "the needs of industrial enterprises." Dziadzio continued that the government and commercial programs "complement each other."

The Ministry of State Assets didn't answer Energy Intelligence's questions about its embrace of SMRs or its influence over the parastatal companies pursuing them. But various nuclear experts in Poland believe it has essentially been taken in by the bullish projections of prospective SMR vendors.

Poland's flirtation with SMRs has two root causes, Maciej Lipka, an expert at the National Centre for Nuclear Research near Warsaw, told Energy Intelligence: the current increase in energy prices and aggressive marketing from SMR vendors. Lipka believes the first cause is "quite straightforward" as "large companies simply need to have cheap electricity ASAP." The second "is a continuation of a long tradition of the nuclear industry that makes unrealistic promises regarding schedules and costs." Lipka believes large reactor vendors have "finally stopped" making such promises, but some SMR developers continue. He cited as an example Last Energy, which in announcing its Jun. 20 agreement with Enea to "jointly pursue" the development of its 20 megawatt SMRs in Poland, said its "development model aims to deliver a power plant within 24 months of signing."

Polish energy industry expert Pawel Zbikowski agreed about "aggressive marketing" by SMR developers, but added that this marketing benefited from "a lack of knowledge" in the Ministry of State Assets regarding the nuclear investment process. "This is a big threat to the 'big' nuclear program, but it could also be an opportunity," Zbikowski said in an email to Energy Intelligence. For example, "the prime minister may take [a] decision to fully start a large program and block the SMR. For now, we have some kind of duality."

Next Steps

For the moment the large reactor program remains the only one with any prospect of near-term contracts. Dziadzio noted that the date of "commissioning of the planned investments" by parastatals in Polish SMRs "will depend on the completion of the first implementation projects in the USA and Canada. Considering the above, it is currently difficult to determine the realistic date of launching individual SMR installations planned in Poland."

On the large reactor program, meanwhile, the schedule is more clear: "A decision on a strategic partnership at the political and

economic level is planned for this autumn,” said Dziadzio. This will allow the government-owned organization in charge of developing Poland’s large reactors “to start the process of selecting contractors for design and construction works” for the first plant. Warsaw will consider “the so-called American offer” — a front-end engineering and design study prepared by Westinghouse and Bechtel, alongside the recently concluded intergovernmental Concept Execution Report — as well as bids from France and South Korea that “were made on their own initiative,” said Dziadzio.

Meanwhile, the government is pushing through legislation that would simplify the investment process and shorten licensing by 12–18 months through a variety of mechanisms. For instance the legislation would shift the government’s “decision-in-principle” from the end to the beginning of the licensing process, explained Lipka, thereby decreasing investor risk. The law should make investment in Polish reactors more attractive, and the Council of Ministers approved the legislation on Aug. 17. Submission to Parliament is slated for the end of September.

Perhaps the biggest investor issue, however, remains unresolved: how will Poland finance its large newbuild program? “A properly selected model largely determines the success of the project,” noted Dziadzio, and both the government and its newbuild development organization are “working on such a model internally.” Dziadzio pointed to multiple models, from contracts-for-difference to power purchase agreements, regulated tariffs and cooperative Mankala-type models, and gave no indication of a preference. With vendor selection only weeks away, it appears that a supplier of Poland’s large reactors will be selected well before Warsaw puts in place a system for paying for them.

Phil Chaffee, London

UNITED STATES

Rising Temperatures Threaten Reactor Safety Margins

Nuclear power is emerging as a popular candidate for combatting climate change, but its heavy reliance on water for safety and cooling is exposing key vulnerabilities, particularly in areas where drought and scorching summer temperatures pose major risks. The issue is nothing new but it came to the fore again this summer when French reactors had to dial back operations in the face of a major heat wave that led to temperature rises in rivers used for cooling water.

Rising water temperatures pose risks for all thermal power plants but experts note that nuclear power is uniquely vulnerable because of its reliance on water to remove heat from plant components during normal operation, for safe planned and unplanned

shutdowns, and for spent fuel storage. In the US, a recently-passed, \$30 billion nuclear production tax credit promises to discourage at least a handful of reactors from early closure. Those tax incentives may encourage operators to spend more capital upgrading aging reactors, but how much will climate change influence those expenditures?

Every year, record-breaking summer heat is challenging nuclear power plants’ ability to generate power safely. Water discharges from nuclear and fossil fuel plants already contribute to higher temperatures in neighboring bodies of water, including rivers, lakes and oceans. But to keep nuclear plants operating when summer demand for air conditioning is highest, some plants require exemptions to discharge heated water beyond their regulatory limits, which only further exacerbates climate change’s already damaging effects on nearby fish and wildlife.

In the US, the average July–August temperature for the last five years has been about 2°F higher than the average from 1960–2000, according to data from the National Oceanic and Atmospheric Administration. Water temperature typically has a nonlinear relationship with air temperature, but a number of studies show water temperature in rivers tends to correlate with a 0.6–0.8°C increase for every 1°C increase in air temperature. Rising temperatures heighten risks to the safe operation of nuclear power plants, and are therefore likely to require plant upgrades to mitigate those risks.

Tackling the Problem

Increasing frequency of “extreme hot temperatures” will require operators of affected plants to make “adjustments” such as “reusing wastewater, recovering evaporated water, improving wet cooling, installing cooling ponds and dry cooling,” the International Atomic Energy Association (IAEA) said in a 2018 climate change report. Such measures obviously add to costs and eat into profits, even with federal tax subsidies, in addition to costs associated with the repercussions of other climate-related events such as flooding, hurricanes and storm surges.

In the US, this is particularly true for reactors in areas where scorching summer temperatures are a perennial problem. Constellation’s Braidwood plant in Illinois and Florida Power & Light’s Turkey Point plant in Florida have in the past two decades frequently sought regulatory approval to increase water temperature thresholds.

Over the next 10–20 years, Moody’s Investors Service warned in a 2020 report that nuclear plants in the US, particularly in deregulated markets, “will face growing credit risks associated with climate change.” Moody’s estimates 48 gigawatts of US nuclear capacity has an “elevated exposure” to both rising water temperatures — particularly in parts of the Midwest and southern Florida — and droughts that reduce the availability of water resources. “The Rocky Mountain states, the Colorado River region and California face the highest levels” of reduced water availability, Moody’s said.

The Union of Concerned Scientists (UCS) estimates that a typical nuclear power plant can consume between 100 and 800 gallons of water per megawatt-hour of electricity. Using those figures, Moody's calculates that if "a 1,000-MW reactor operating at a 90% capacity uses 450 gallons of water per megawatt-hour, the reactor's annual water consumption would total about 3.5 billion gallons."

Elevated temperatures can also force a plant "to curtail production or shut down temporarily, as happened at the Tennessee Valley Authority's Browns Ferry nuclear station in Alabama in 2010, Millstone plant in Connecticut in 2012, for which Dominion is the primary owner and operator, and nuclear plants in Europe during the summer of 2018," Moody's reports.

The problem is so serious that the IAEA's 2018 report urged new-build planners to pick sites in "cooler local climates where possible" and "different cooling designs" to "mitigate the decreasing thermal efficiency of generation and decreasing cooling efficiency resulting from higher mean temperatures."

France: A Case Study

The French nuclear fleet has long been a case study of the impact of rising water temperatures on reactor operations, with exemptions to regulatory thresholds granted during extreme heatwaves dating back at least to the early 2000s. France's Nuclear Safety Authority (ASN) says such exemptions are necessary to ensure there is enough power to meet demand. This summer proved no exception, with more than half of EDF's fleet shut down and Europe facing an acute energy crisis due to the fallout from Russia's invasion of Ukraine. In July, France's EDF reduced power output at a handful of plants after temperatures in the Rhone and Garrone rivers rose to 40 degrees Celsius (104 degrees Fahrenheit). In August, the ASN exempted five EDF reactors from regulatory discharge temperature thresholds until mid-September.

In France, thermal discharge limits are imposed on a plant-by-plant basis, based on temperature rises "downstream of the nuclear power plant, as well as environmental monitoring methods," the ASN explained in an Aug. 8 release. If temperatures are too high, the "power of the reactors is lowered to reduce the effect of thermal discharges on the natural environment" or the reactor is completely shut down. But "if the electricity network operator (RTE) expresses the need to maintain a minimum power to ensure the security of the electricity network," an exemption to temperature limits will be granted along with an "enhanced environmental monitoring program."

Similarly, limits in the US vary by plant design, water resource and region. While the US Nuclear Regulatory Commission (NRC) regulates water temperature limits on a site-by-site basis to ensure water supplied to reactors is cool enough to maintain safety margins, discharge of heated water is typically regulated at the state level through the National Pollutant Discharge Elimination System program.

A nuclear power plant's cooling water system is termed its ultimate heat sink (UHS). According to the NRC, a UHS must "dissipate the heat of a design-basis accident of one unit" and "the heat of a safe shutdown and cooldown of all other units." A UHS must also provide a 30-day "supply of cooling water at or below the design-basis temperature for all safety-related equipment" as well as "be capable of performing under the meteorological conditions leading to the worst cooling performance and the conditions leading to the highest water loss."

According to NRC spokesperson Scott Burnell, nuclear power plants "bear the burden of demonstrating they can maintain UHS functionality." If water temperatures increase beyond the UHS threshold, nuclear power plant operators can request from the NRC "enforcement discretion if the plant can justify the issue being short-lived and that safety margin is maintained" or through "license amendments to permanently alter the plant's UHS technical specifications."

Jessica Sondgeroth, Washington

UNITED KINGDOM

Johnson's Valedictory Nuclear Push

Outgoing UK Prime Minister Boris Johnson's valedictory speech this week at Sizewell, where EDF hopes to build twin EPRs, was reflective of his government's approach to new nuclear capacity: replete with bold exhortations about the importance of nuclear energy, but offering very little of substance.

The "up to" £700 million (\$809 million) of government funds that Johnson pledged to invest in the Sizewell C newbuild project is part of the £1.7 billion already earmarked for a large newbuild project back in October. The question now is whether Johnson's successor, who will be announced Monday after selection by Conservative Party members, is willing to commit significantly more government money to get Sizewell C and possibly other newbuild projects off the ground.

"With the prophetic candor and clarity of someone about to hand over the torch of office, I say go nuclear and go large and go with Sizewell C," Johnson said in a Sep. 1 speech at the Sizewell plant in Suffolk, in southeast England. "We are putting up to £700 million into the deal," he explained, "and in the course of the next few weeks I am absolutely confident that it will get over the line. And we will get it over the line because it would be madness not to."

That £700 million ought to go a long way toward funding pre-FID (final investment decision) costs which is no small matter considering that EDF said Jul. 28 that its "ability to continue the

development is subject to reaching an agreement with the UK government, in particular on the funding of the remaining development costs until FID.”

EDF didn’t respond to Energy Intelligence questions, however, over whether it was only weeks away from getting over the line. But a Sizewell C spokesperson provided the following statement: “This year alone has seen huge progress on the project; the passage of the Nuclear Financing Bill through Parliament with an overwhelming majority, the granting of the Development Consent Order (DCO) and the whole-hearted backing for nuclear in the Government’s Energy Security Strategy. These foundations mean that we are closer to delivering on the benefits Sizewell C will bring to Britain — from the provision of low carbon energy for millions of people to the creation of tens of thousands of highly skilled jobs across the country.”

Getting ‘Over the Line’

Closer, perhaps, but considerable distance remains. Because getting Sizewell C “over the line” to either an investor agreement or a FID is a tall order.

An investor agreement requires current 20% Sizewell C owner China General Nuclear (CGN) bowing out of the project, but at what cost — and who pays it — remains to be seen. It also requires EDF to sell down its own interest in the project from 80% to under 20%, as the French state-owned company has made clear that the project cannot be consolidated on its balance sheet, which would happen if its ownership exceeds 20%. And this means that even if the UK government takes 20% in Sizewell C, EDF will still need to secure investors for another 60%, and given the company’s newbuild track record that’s a difficult task.

Getting Sizewell C to a positive FID, meanwhile, is an even more complex task. Project developers must negotiate the exact scope and nature of the UK’s “government support package” under the already in-place nuclear regulated asset base (Rab) model. That model, which allows investors to receive revenues from ratepayers during the construction period, depends on this government support package meant to backstop extreme one-off macro risks such as pandemics or rapid currency movements.

That package, and a detailed Rab agreement, may attract the investors and debt holders needed to get to FID, but even then the scheme will first need to achieve an investment grade credit rating, EDF has warned.

Even then EDF has highlighted one further headwind: “the risk of judicial review of DCO decision”, referring to the development consent order granted by the government Jul. 20. And while Johnson gave his speech at Sizewell this risk grew, as the Together Against Sizewell C group issued legal proceedings against the DCO decision. The anti-Sizewell C group argued that because the government issued the DCO against the advice of the planning Examining Authority that reviewed EDF’s DCO application, it should be deemed unlawful.

The Examining Authority had accepted Together Against Sizewell C’s argument that the water supplies relied on in the Sizewell C plans were not climate resilient, and had recommended against issuing the DCO “unless the outstanding water supply strategy can be resolved.”

Phil Chaffee, London

INTERVIEW

Bechtel’s Tokpinar on TerraPower, Advanced Nuclear

Last week Ahmet Tokpinar, Bechtel’s head of nuclear operations, spoke with Energy Intelligence’s Phil Chaffee about the company’s role in AP1000 nuclear newbuilds. In the second half of Tokpinar’s Aug. 10 interview below, he discusses Bechtel’s work in the advanced nuclear space.

Q: For the past two years you’ve worked with technology developer TerraPower on the Natrium sodium fast reactor. Do you foresee a role on the Natrium similar to what you propose for AP1000 projects, as an integrator and EPC (engineering, procurement and construction) contractor all wrapped together?

A: Well we are their EPC contractor. We’re already working with them in that role. It’s the second year of our joint execution, but we’ve been working with TerraPower for longer than that. We have a very good complementary skill set and they’re an excellent company, very innovative. Our skill set of more experienced EPC brings very complementary skills of innovation and experience.

We’re extremely excited about what we’re doing with them. We’ll build the demonstration unit in Wyoming. We have recently completed all the site investigation work — the geotech work we completed about a month ago. That’s a good example of how we are setting our integrated EPC tools to make that project a success. And it will be.

Q: How are you thinking about the first-of-a-kind challenges there?

A: Every component of that project has been proven somewhere before. It’s not about whether the technology will work or not. It’s first-of-a-kind because you’re designing something from scratch, but you’re utilizing proven concepts.

I don’t think it’s a big challenge. We’re gonna test the supply chain in the US. I think there’s normal learning that will occur, but I don’t expect this project to be anywhere near what other technologies have gone through. Because there’s quite a bit of lessons learned on how to approach these developments, the better tools, the modeling. There’s a far better process as you go through the design challenges than before.

The biggest lessons learned, I can tell you Phil, is that a lot of these reactor concepts in the beginning never involved an EPC contractor like us that looked at constructability: whether it makes sense, how you build what you're designing.

The advantage that we bring in with TerraPower is that we're there with them. We're designing some parts, they're designing others. But we are looking at every piece, whether it can be built in a practical way, so that we don't have any issues when we're at the site, pointing fingers and saying 'You can't build this, it's too congested, it's too tight, there's not enough margin.'

Q: Beyond TerraPower and Westinghouse, do you envision partnering with any other companies in the newbuild space?

A: We're in discussions with others. We've tried to pick players from different categories of nuclear — large, small, advanced. So we have some discussions for small modular reactors — I'm not at liberty to have that discussion with you now — but I think it's going to be a mix of different technologies. We are almost always technology neutral. But when we see a technology that makes sense and is better than its peers and competitors we don't shy away.

Q: Obviously, you're not naming names, but I am curious. As a reporter, it's very hard for me to evaluate which technologies and companies are most serious out of the dozens or even hundreds of SMR advanced reactor vendors that put out bullish statements and very slick PowerPoint presentations. How do you evaluate these firms and decide which are most serious, and which are most ready to be commercial?

A: We have a process through which we evaluate every single reactor technology out there. We rank them. We look at their technical feasibility, we look at their cost feasibility — whether you can build it or not. And we have discussions with them periodically, we look at the journals and at the available information.

So we have our own assessment from the perspective of an EPC, not an owner-operator. We look at the teams, we look at different aspects of development, and the funding they have, because at the end of the day the funding is very important. You may have the best technology but if you're always worried who's providing the next year's funding you're going to lag behind. So we look at the funding, who are their financial backers? Are they credible? Are they gonna be around in two years?

There's a lot of practice and we have our favorites. And if we want to have a closer relationship, sometimes we approach them. And quite frankly, the Natrium TerraPower design was at the top of our list. We knew the company well, we were helping them for 4-5 years, and we told them that we wanted to partner with them. So that's how our relationship grew even stronger and bigger, with the ARDP [the US Department of Energy's Advanced Reactor Demonstration Program] application we jointly submitted.

There are a lot of players. There's a lot of hype. We know what we think is achievable, and when we find good fits, we have a discussion.

Q: Following up on that, you talk about going into each space in nuclear. Does that include fusion? Is that something you're looking at too?

A: We are. We're not active, because it's very limited what we can contribute today. They need to prove their physics. But there are a few companies that we meet on an annual basis and have discussions with. One out of the US, one out of the UK, and one just reached out to us. So we do talk to them.

I think it's going to happen. I'm not a physicist, so I couldn't tell you when. But there's so much money coming in. And in our experience, if you throw enough money, you solve the problem. They — the fusion projects — have some challenges, but there are a couple of very good companies, with very smart people, and with really good financial backing.

Q: But the point at which you want to become involved is once they've solved the fundamental physics, and they're looking much more to commercial design?

A: Exactly. Because we couldn't help them with the physics, we couldn't help them with their demonstration fusion reactor.

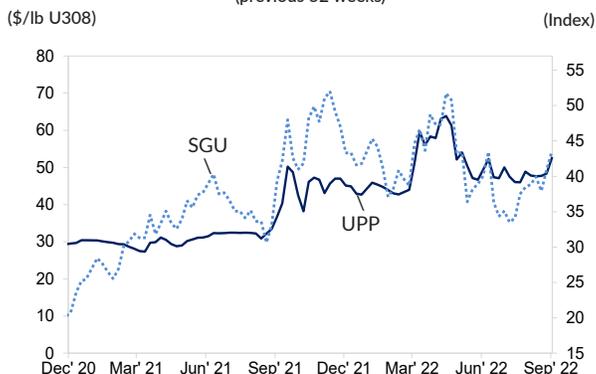
If they can have a sustainable energy — when they're getting more energy out than they're putting in, and they can maintain that on a continuous basis — around that time, you're going to have a discussion over 'How do you capture that heat?' Because that's another challenge that hasn't been solved. How do you transfer the heat for power generation? That's where we come in and design a power plant around the fusion reactor.

Phil Chaffee, London

URANIUM MARKET UPDATE

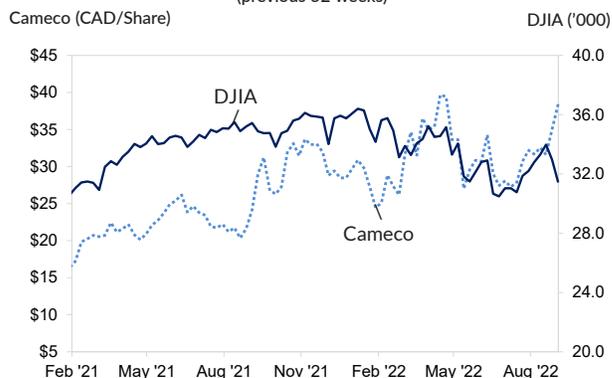
All prices as of Thursday, September 1, 2022

UPP VS. SOLACTIVE GLOBAL URANIUM INDEX
(previous 52 weeks)



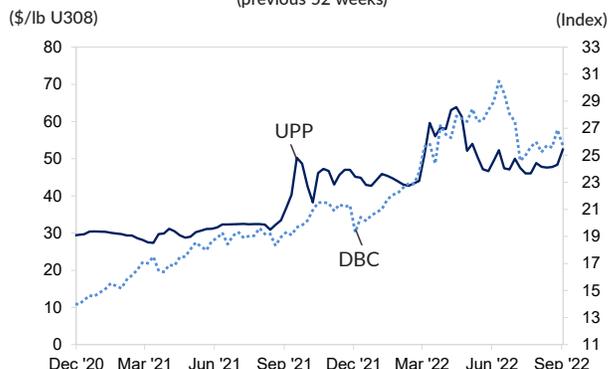
The Solactive Global Uranium Total Return Index, created by Structured Solutions AG, tracks the price movements in shares of companies active in the uranium mining industry. Calculated as a total return index and published in US\$, its composition is ordinarily adjusted twice a year.

CAMECO VS. DOW JONES INDUSTRIAL AVERAGE
(previous 52 weeks)



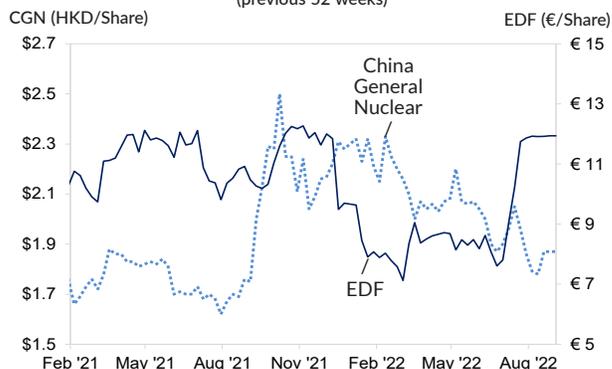
Canadian uranium miner Cameco's stock is valued in Canadian dollars compared with the US dollar on the Dow Jones Industrial Average (DJIA). Roughly two-thirds of DJIA's 30 component companies are manufacturers of industrial and consumer goods. The others represent industries ranging from financial services to entertainment.

UPP VS. POWERSHARES DB COMMODITY INDEX
(previous 52 weeks)



The PowerShares DB Commodity Index Tracking Fund is designed to provide investors with a broadly diversified exposure to the returns on the commodities markets. It is based on the Deutsche Bank Liquid Commodity Index, which is composed of futures contracts on 14 of the most heavily traded and important physical commodities.

EDF VS. CHINA GENERAL NUCLEAR
(previous 52 weeks)



The stock valuation of France's Electricite de France (EDF), largely owned by the French state, is in euros compared to state-owned China General Nuclear (CGN) Power Co., valued in Chinese yuan renminbi. Both companies build nuclear power facilities, design and service reactors, operate nuclear reactors and supply nuclear components and technology.

MONTHLY SPOT MARKET PRICES

	Chg.	2022								2021			
		Aug	Jul	Jun	May	Apr	Mar	Feb	Jan	Dec	Nov	Oct	Sep
Uranium (\$/lb U3O8)													
Low	+2.00	47.50	45.50	45.50	46.00	52.50	51.00	42.50	43.00	42.00	43.00	36.00	36.00
High	+3.00	53.50	50.50	52.50	54.00	64.00	60.00	44.50	46.50	47.00	47.50	48.00	51.00
Conversion (\$/kgU)													
Low	+4.00	36.00	32.00	30.00	30.00	28.00	26.00	16.00	16.00	16.00	15.00	16.00	19.00
High	+2.00	39.00	37.00	33.00	33.00	30.00	28.00	17.00	17.00	17.00	18.00	19.00	21.00
Enrichment (\$/SWU)													
Low	+0.50	90.00	89.50	84.00	84.00	82.00	100.00	59.00	57.00	56.00	56.00	55.50	55.50
High	-3.00	92.00	95.00	150.00	150.00	150.00	150.00	61.00	59.00	57.00	57.00	57.50	57.50

NIW monthly UF6, SWU and U3O8 prices rely on the general consensus of direct market participants and is informed by actual market transactions. This section was previously known as the Nukem Weekly Report and the Nukem Price Bulletin. The methodology for NIW's weekly UPP price is different - more information about the methodology behind that price is available on page two.

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