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NUCLEAR INTELLIGENCE WEEKLY®

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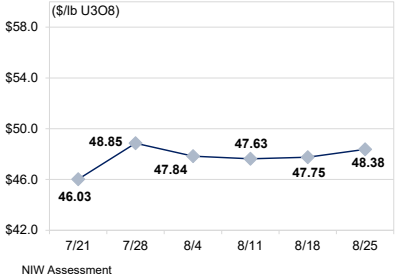
Market Points

With Tokyo pushing for seven reactor restarts next year, Canadian miner Cameco said it has "a team over in Japan this week meeting with customers talking about their needs for the future."

Although spot uranium activity remains sparse, a lack of sellers helped lift the average spot price delivered by Energy Intelligence's Uranium Price Panel to $48.38 per pound U3O8 on Aug. 25, up 1% from last week.

Orano and Kazatomprom joint venture Katco got regulatory approval to extend the life of the world's largest in situ operation, as existing resources Muyunkum and Tortkuduk are near depletion.

UPP: $48.38/LB U3O8



WEEKLY ROUNDUP

Kishida Pushes for More "Indispensible" Nuclear Power

- Japanese Prime Minister Fumio Kishida hopes to speed up restarts of idled reactors, and plans to set in motion work on "innovative reactors" for construction in the 2030s. Kishida told the Aug. 24 second meeting of a Cabinet-level advisory council that nuclear power is "indispensible," and "it is necessary to mobilize the collective efforts of all parties concerned toward" nuclear restarts. Further details are unlikely before year's end, but a report by Economy, Trade and Industry Minister Yasutoshi Nishimura called for the restart "around next summer or winter" of seven reactors, on top of the ten currently operational. In the second half of the 2020s the report envisaged Nuclear Regulatory Authority safety reviews of 10 reactors for which restart applications have been made and nine for which they haven't. That's in line with a 2030 target of nuclear providing 20-22% of Japan's electricity. Nishimura also outlined a menu of long-term energy strategies including "innovative reactors," renewable energy and upstream resource security.

- One unit of Ukraine's Russian-occupied Zaporozhye nuclear plant was reconnected to the grid at 2:04 pm today, Aug. 26, operator Energoatom said, ending a temporary disconnection from the Ukrainian grid. The plant had "temporarily lost connection to its last remaining operational 750 kilovolt (kV) external power line" on Aug. 25, Ukraine had informed the International Atomic Energy Agency (IAEA). The power loss forced workers to shut down the last two remaining operating units. There was no information on the direct cause of the power cuts, although it comes amidst a series of shelling incidents in the area — three of four external power lines were lost earlier during the conflict. The incident further underlined "the urgent need for an IAEA expert mission to travel to the facility," said the agency. On Aug. 24 IAEA Director General Rafael Grossi met in Istanbul with Russian diplomats and with Rosatom head Alexey Likhachev for "technical discussions" over what Grossi called an "imminent" IAEA mission to Zaporozhye.

- Diplomatic skirmishing continued today, the final day of the month-long Tenth Review Conference (RevCon) of Non-Proliferation Treaty (NPT), as 191 member states sought agreement on a final statement. Diplomats worked around the clock to achieve consensus on the document, which looks set to be the longest in RevCon history, and which can only happen if there are no formal objections. Talks were bogged down by an issue unlike any in previous RevCons: Russia's occupation of the Zaporozhye nuclear plant and continued fighting in and around the Ukrainian plant. With that situation added to the lack of progress on nuclear disarmament as called for under NPT Article 6, UN Secretary-General Antonio Gutteres said earlier this week that "the nuclear risk has climbed to its highest point in decades." Gutteres was speaking at a special UN Security Council session at which the RevCon's president, Gustavo Zlauvinen, was invited to speak. Beyond those two issues, delegates were also debating language over safeguards for the so-called Aukus deal involving the transfer of US and UK nuclear propulsion technology to Australia. Aukus has been stridently criticized by China and others.

NUCLEAR FUEL MARKET

Investor Rally on Japan's Restart Push

The spot uranium price gained a little momentum this week on investor fervor over news that Japan will ramp up reactor restarts next year. But given the overhang of Japanese nuclear fuel inventories that has weighed down the nuclear fuel market over the past decade, other fuel market participants are more measured in their expectations.

Spot uranium activity was still rather thin this week, but a lack of offers helped push the price higher. Energy Intelligence's Uranium Price Panel delivered an average spot price of $48.38 per pound U3O8 on Aug. 25, up marginally from $47.75/lb. U3O8 on Aug. 18.

Japan's economy and trade ministry is calling for the restart "around next summer or winter" of seven reactors, on top of the 10 currently operational, including regulatory safety reviews beginning after 2025 for 19 reactors, 10 of which have already initiated restart applications.

Cameco CEO Tim Gitzel boosted the Japanese restart news in an interview with Bloomberg this week when he noted that it "adds to the necessity to" restart the McArthur River uranium mine and Key Lake mill, a Cameco joint venture with Orano. "It's really good news for us, in fact we have a team over in Japan this week meeting with customers talking about their needs for the future," he added.

Gitzel reiterated that McArthur, in northern Saskatchewan, will be operational by the end of this year with a ramp-up over the next two years to 15 million pounds per year (100% basis). In an earnings report earlier this month, Cameco noted it has the flexibility to slow down the reduction in output from 15 million lbs. to 13 million lbs. at the nearby Cigar Lake mine and increase output at McArthur all the way to its capacity of 18 million lbs. if the market calls for it.

But for other traditional market participants, the Japanese news was not a big mover of supply-demand fundamentals. In the near term, the return of seven more reactors falls in line with previous plans and still doesn't necessarily mean Japanese utilities will be out buying nuclear fuel in droves. That's mainly because, post-Fukushima, Japanese utilities still hold large volumes of inventories at Western fuel fabrication facilities and converters.

Although there have been occasional reports of Japanese utilities shedding inventories in the market — either in the form of sales to traders and producers or loans to producers and utilities to be repaid in-kind on an as-needed basis — sources say this hasn't been sufficient enough to warrant a looming demand surge.

Meanwhile in the world's largest uranium-producing country, the Kazakh mining ministry this month granted a license for Katco, an Orano and Kazatomprom joint venture, to develop the South Tortkuduk Block of the Muyunkum uranium deposit, extending the life of the world's largest in situ operation. This will offset the joint venture's depleting resources in nearby Muyunkum and Tortkuduk, Orano clarified to Energy Intelligence this week.

Production at the South Tortkuduk uranium deposit, with estimated uranium reserves of 46,000 tU (120 million lbs. U3O8), is scheduled to begin in 18 months. "Given the work required to bring this new block into production," the project combined with depletion at Muyunkum and Tortkuduk will bring total Katco production down "to approximately 65% of its nominal capacity (about 2,600 tU/yr) for the next two years," Orano said. Katco expects to return to its full annual production level of about 4,000 tU "in 2026 at the earliest," where it will remain throughout the project's useful life of about 15 years.

Kazatomprom and Orano signed an agreement in April 2017 for further development by Katco on the basis of the South Tortkuduk mine. The agreement entitles Kazatomprom "to an additional 11% compensation from distributable profit" from the joint venture starting from the beginning of this year and through the end of the license period.

Katco's annual output grew from 3,000 tU in 2009 to 4,000 tU from 2013-16, according to Orano. From 2017 to 2020, Katco decreased its production by 10% and then by 20% "like other mines in Kazakhstan and in line with production adjustments worldwide."

Jessica Sondgeroth, Washington

URANIUM PRICE PANEL

For the week ended August 25, 2022

Weekly Spot Market Prices

		Aug				Jul				June				
	Chg.	25	18	11	4	28	21	14	7	30	23	16	9	3
Price ($/lb U3O8)	0.63	48.38	47.75	47.63	47.84	48.85	46.03	46.04	47.53	50.00	47.13	47.39	52.25	49.40
Total Assessments	-1.00	9.00	10.00	9.00	8.00	9.00	10.00	9.00	10.00	10.00	10.00	11.00	10.00	10.00
% within 1 StDev	-2.22	77.78	80.00	77.78	75.00	55.56	80.00	55.56	70.00	60.00	90.00	72.73	70.00	40.00
Low ($/lb U3O8)	0.50	48.00	47.50	47.25	47.50	48.50	45.75	45.50	47.00	49.25	47.00	46.60	51.70	49.00
High ($/lb U3O8)	0.75	49.00	48.25	48.00	48.25	49.25	46.25	46.75	48.50	50.75	47.50	48.50	52.50	50.15
Variability*	0.13	0.38	0.25	0.04	0.00	0.00	0.00	0.31	0.50	0.16	0.06	0.09	0.40	0.32

*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.

UKRAINE

Zaporozhye Personnel Stuck In Impossible Quandary

Moscow fully intends to utilize the Russian-occupied Zaporozhye nuclear power plant plant for Ukrainian territory it now controls, and possibly for power supplies to Russia itself, according to knowledgeable expert observers in both Ukraine and Russia. These experts agree that neither side wants a catastrophe, but they admit such an outcome cannot be ruled out given the sheer amount of military activity in the vicinity and the utterly unconducive working environment for plant personnel. This helps explain why Russian and even some Ukrainian experts approve of the presence of Rosatom officials at the plant and believe that international observers should carry out a visit. The exact constituency of such an observer mission, however, is a very touchy matter.

Statements out of Russia, as well as Russia-controlled parts of Ukraine, suggest that Moscow will not give back any territories it has seized and may even annex them, much as it did with Crimea in 2014. Regardless, these regions will require a low-cost power source, and the 6,000 megawatt Zaporozhye nuclear power plant has more than enough to go around. "As far as the Zaporozhye plant 'everything is clear,'" said a Moscow-based observer. "It'll be delinked from the Ukrainian grid, which is why the shooting started there. The likeliest result is a draw, and the plant will be shut. So it won't work for either Kyiv or for the southeastern [Ukrainian] regions" under Russian control, the observer said.

This week Zaporozhye was temporarily de-linked from the power grid. This underlined a key concern of Ukrainian observers: that Russian authorities will attempt to redirect the output of the plant, which at the start of the week was operating only Units 5 and 6. Russian-occupied areas of Ukraine include multiple power demand centers, from large towns such as Melitopol, Berdyansk and Mariupol on the northern coast of the Sea of Azov, to the besieged Kherson to the west and then in the south Crimea itself. That combined region likely can't soak up the total output of Zaporozhye's six reactors, however, meaning a Russian-occupied plant would have to find a way to sell kilowatts across the divide to Ukrainian controlled territory, or to Russia itself. For now there is no grid connection between southeastern Ukraine and the Russian region of Rostov, but experts don't rule out that such a link would be eventually built.

Uncomfortable Moral Calculus for Operators

What is crucial to understand is that removing the plant from Ukrainian control and using it to power occupied regions would put Zaporozhye staff in extreme moral duress. Authorities in Kyiv are likely to consider this to be an act of treason, with all the attendant consequences. On the other hand, if plant managers refuse to do Moscow's bidding, they and their families risk reprisals from Russian forces.

For as Ukrainian experts argue, without the current Zaporozhye personnel, Russia cannot operate the plant. Zaporozhye's six VVER-1000s may be Russian technology, but over recent years they have undergone such extensive upgrades that managers from similar reactors in Russia could not conceivably operate the Zaporozhye units, Ukrainians say. Most notably, Soviet-era instrumentation and control systems have been replaced with state-of-the-art imported systems, and radiation control and post-accident monitoring (black box) systems have been modernized.

Nearly 1,300 separate modernization measures were slated at the country's 15 nuclear reactors as part of the Complex Program for Security Enhancement that started several years ago, and as of last December, some 1,048 were completed, according to reports citing Energoatom. Given the scope of these changes and how drastically they have altered plant technology, "Rosatom officials have no business" going anywhere near the Zaporozhye control rooms, said one Ukrainian expert.

Vital Liaison

And yet Rosatom's presence at the plant is necessary, experts from both sides concur, since only they can competently serve as a liaison between plant managers/operators and troops based on site. Rosatom officials do not want to interfere with plant operations, the Moscow-based observer said, "but their presence is mandatory since the Ukrainian personnel are in a very complicated predicament. They're under pressure from Kyiv, and the situation is unpredictable. If Rosatom folks aren't there, then the communication between Ukrainian personnel and Russian military would be very difficult."

Some Ukrainian observers give a similar assessment. Only professional nuclear officials from Russia can "dial down" the tension between plant staff and armed soldiers in camouflage. According to the Ukrainians those soldiers have threatened employees and even confiscated their passes so that outsiders — ostensibly officials from Russia — can enter closed areas of the Zaporozhye complex.

Meanwhile, both Ukraine and Russia — not to mention the global community — await the arrival of a mission from the International Atomic Energy Agency, which could take place as soon as next week. However, both sides have completely different expectations: Moscow wants to demonstrate that its troops are not a hindrance to plant operations, while Kyiv intends to prove to mission members that Zaporozhye staff are stuck in an impossibly stressful situation. Meanwhile the Ukrainians fear that Moscow will conceal troops and tidy up the premises during the mission, which may not be given access to employees whom Russian soldiers have hassled, if not worse.

This is why Ukrainian authorities are insisting that not a single Russian citizen be included in the mission. They cannot be trusted, the Ukrainians claim. But given the sheer number of Russians in the IAEA, as well as the World Association of Nuclear Operators, this makes compiling an expert group of observers rather complicated.

As the Ukrainians point out, it took Wano five months to release a statement about the situation around the Zaporozhye plant, and even then it failed to mention the presence of "occupying forces."

Gary Peach, New York

NUCLEAR FUEL

US, EU Requirements Fall in 2021, With Inventories

Combined 2021 nuclear fuel data from the EU and US captures the lowest demand forecast in nine years, but of necessity leaves out what's needed for a truly reliable forecast: namely the ultimate impact on global nuclear fuel markets of Russia's invasion of Ukraine earlier this year. Any reliable supply-demand forecast may have to wait until political leaders on both sides of the Atlantic provide regulatory clarity on Russian-supplied nuclear fuel, which makes up roughly one-third of US and EU demand.

US Energy Information Administration (EIA) and Euratom Supply Agency data for 2021 reflect a year not only of declining demand, but also of smaller inventories and a larger share of unfilled utility requirements in later years. Investors continue to scoop up physical uranium while governments, operators and developers take steps to preserve existing nuclear reactors and develop new reactors for commercial use over the next decades. Russia's ongoing war in Ukraine has increased the risk of sanctions on Russian nuclear fuel shipments, threatening supply disruption. This leaves buyers uncertain about how to shape their future supply portfolios and whether to include Russian material. The US Congress has also passed production tax credits, effective in 2024, that promise to save at least a handful of reactors from early closure over the following decade.

"Russia's invasion of Ukraine has created a new context for the EU's security of supply for nuclear materials," Euratom observed in its 2021 annual report released earlier this month. This calls for "a revision of the risk assessment, including transport and storage aspects, development of the risk preparedness plans, long term diversified contracts and maintaining strategic stocks. It also encourages strategic industrial investment."

Amidst uncertainty over how nuclear fuel supply and demand will crystalize over the next several years, term contracting remains less than robust. And this reality exists alongside the seemingly contrary, arguably bizarre, spectacle of investors procuring and sequestering uranium concentrate. This speculative sideshow has helped push up uranium prices even in the absence of real end-user demand: total EU and US uranium requirements for the subsequent decade fell from nearly 342,000 tons of uranium in 2014 to 245,000 in 2021 as reactors are retired without being replaced.

That fall in requirements has prevented major capacity additions that might eventually be needed. Even further up the front-end supply chain, western enrichers Orano and Urenco are in talks but still awaiting demand signals from utilities in the form of meaningful long-term commitments.

Security of Supply

Per 2021 data, requirements in the US and EU are on the decline. Over nine subsequent years, utility requirements have dropped from an average of 34,100 tU per year in 2014 to 24,800 tU/yr in 2021. For sellers, that is caveated by lower inventories and an increased share of unfilled requirements going forward.

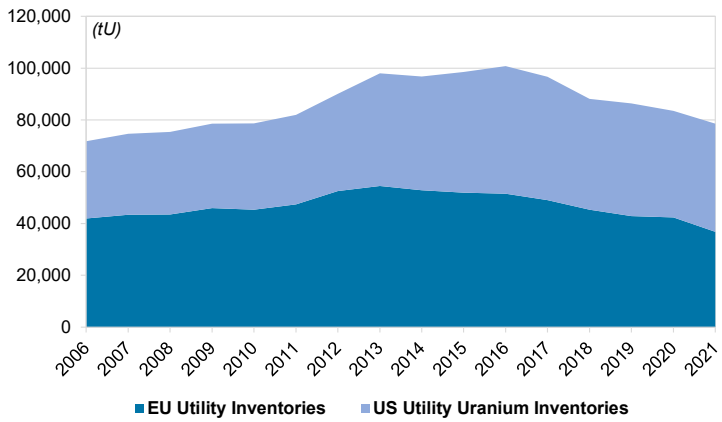
"In the US, over the last three years or so, the utilities were implementing this cut down on their carrying costs, you know, burn inventories rather than contract," one industry veteran and market consultant told Energy Intelligence. "So there was that noticeable dip in unfilled requirements." Similarly, in the EU, inventories have dropped because over the past eight years utilities have loaded more material into reactor cores than they bought, "in parallel with decreasing needs," according to Euratom. Euratom estimates that average inventory levels represent about three years of supply.

And yet, future uncovered demand accounted for about 43% of total requirements for the next nine years. That figure was closer to 30% in 2020. But the problem with 2021 figures is that they do not take into account the growing risks around security of supply, something that might not have been such a pressing concern to buyers until early in 2022.

Russian Factor

In the US and EU, Russia supplies about one-third of enrichment requirements. In the US, of the 14.2 million separative work units (SWU) purchased by US utilities in 2021, 28% came from Rosatom subsidiaries Tenex and Tvel and US-based Centrus Energy, which trades Russian SWU, according to the EIA's annual Uranium

EU AND US UTILITY-OWNED URANIUM INVENTORIES



Source: US Energy Information Administration, Euratom Supply Agency, Energy Intelligence

Marketing Report released in May. About 60% came from European consortium Urenco's plants in Europe and the US state of New Mexico. And though figures for French-supplied SWU were withheld, the remaining proportion of SWU sales to the US would suggest about 12% came from France's Orano.

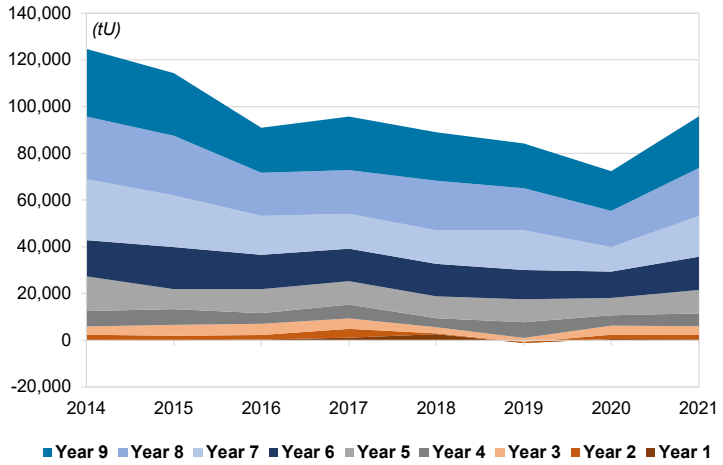
In the EU, 2021 deliveries under purchasing contracts declined by 9% from the prior year to a total of 10.3 million SWU, of which Russia provided 31% of total deliveries. And while Euratom does not break out SWU by country of origin, except for Russian SWU, the remaining 69% of SWU delivered to EU utilities in 2021 is likely spread out between Urenco and Orano.

Urenco and Orano have both stated that they need firm utility commitments for substantial term volumes to invest in capacity increases. The same can be said for western UF6 producers, including Cameco in Canada, Orano in France and Honeywell in the US, which is planning the 2024 restart of the Metropolis UF6 plant in Illinois. Adding to the outlook uncertainty, the EU and the US are also currently evaluating whether they can keep some nuclear plants running longer, to offset geopolitical risks in energy supply and to help meet decarbonization goals.

"Earlier decisions to retire nuclear capacity are in some cases being reversed and in some countries, public opinion seems more receptive to viewing nuclear power as a contributor to decarbonization, also via hydrogen production," Euratom said. "Alongside large electricity-producing nuclear reactors, small and modular ones, both land-based or maritime, are constantly mentioned as options to power remote sites and projects."

All of these fundamentals have helped push uranium prices higher, but without much real end-user demand to back this year's price rallies. In the US, total deliveries received by brokers and traders gained about 9 million lbs. U3O8 in 2021, to 43.5 million lbs., from the prior year. Of that total, 42.5 million lbs. were of foreign origin with less than 1 million lbs. produced domestically.

EU AND US UTILITY UNCONTRACTED URANIUM DEMAND OVER SUBSEQUENT 9 YEARS



Source: US Energy Information Administration, Euratom Supply Agency, Energy Intelligence

However, given that only 16.6 million lbs. came from outside the US, US brokers and traders were likely responsible for "churning" as much as 27 million lbs. of material, likely between themselves. And that doesn't include the 76 million lbs. in total sequestered by financial firms Sprott Asset Management in Toronto and Yellow Cake in London.

Jessica Sondgeroth, Washington

CHINA

'Orderly' Newbuild Program On Course to Miss 2025 Target

China's foot is firmly on the pedal in its drive to increase nuclear capacity and meet climate change goals. But despite an accelerated newbuild approval process, Beijing looks set to fall short of its 2025 goal of 70 gigawatts of gross nuclear operating capacity by at least 5 GW and possibly more.

In its key midterm energy plan rolled out last year Beijing called for "proactive and orderly" development of nuclear power as part of its effort to peak carbon emissions by 2030. The urgency to accelerate its nuclear newbuild program and approval process for new reactors is intensifying as the country, like many others across the world, grapples with power crunches from heat waves and other extreme weather events. But achieving 70 GW of new nuclear capacity appears impossible, and even achieving 65 GW by the end of the current five-year plan (2021-25) will be an uphill climb.

David Fishman, a senior manager with the Lantau Group energy consultancy, argues that the 70 GW target may take a year or two longer to be met, and could be reached in 2026 or 2027. China has been growing its nuclear fleet by around four to five units annually in recent years, Fishman noted, but would need to accelerate the pace to seven or eight units per year if Beijing wants to increase reliance on nuclear as a means of meeting its 2060 carbon-neutral commitment.

In the near term much depends on the ability of the country's two biggest developers — China National Nuclear Corp. (CNNC) and China General Nuclear (CGN) — to meet their timetables for building new (and in CGN's case, first-of-a-kind) indigenously designed Hualong-One reactors, or HPR1000s. Installed gross nuclear capacity in China is currently close to 56 GW, including two units that began commercial operations this year and three others that did so last year. That leaves a gap of approximately 14 GW to fill in order to meet Beijing's 2025 target. However, reactors currently targeted by their developers for commercial operation in that time frame would yield at best an additional 6.1 GW of capacity, and if two demonstration CAP1400s being built by State Power Investment Corp. (Spic) at Shidao Bay in Shandong are included, the figure would still only climb to 9.2 GW.

Chinese Reactors Starting Commercial Operation Since Jan. 1, 2021

Reactor	Model	Province	Controlling Owner	First Concrete	Grid Connection	Commercial Operation	Months of Construction	Net MWe
Fuqing-5	CNNC HPR1000	Fujian	CNNC	May 7'15	Nov 27'20	Jan 29'21	68	1,075
Tianwan-6	CNP-1000	Jiangsu	CNNC	Sep 7'16	May 11'21	Jun 2'21	56	1,060
Hongyanhe-5	ACPR-1000	Liaoning	SPIC / CGN	Mar 29'15	Jun 25'21	Jul 31'21	76	1,061
Fuqing-6	CNNC HPR1000	Fujian	CNNC	Dec 22'15	Jan 1'22	Mar 25'22	75	1,075
Hongyanhe-6	ACPR-1000	Liaoning	SPIC / CGN	Jul 24'15	May 2'22	Jun 23'22	82	1,061
							Total MW:	5,332
						Average Months:	71	

Chinese Reactors Targeted for Commercial Operation by Dec. 31, 2025

Reactor	Model	Province	Controlling Owner	First Concrete	Grid Connection (Target)	Commercial Operation Target	Months of Construction	Net MWe
Shidao Bay-1	HTR-PM	Shandong	China Huaneng	Dec 9'12	12/14/2021	2022	116-120	200
Shidao Bay-2	HTR-PM	Shandong	China Huaneng	NA	NA	2022	NA	NA
Fangchenggang-3	CGN HPR1000	Guangxi	CGN	Dec 25'15	NA	H2'22	80-84	1,000
Fangchenggang-4	CGN HPR1000	Guangxi	CGN	Dec 23'16	NA	H1'24	84-89	1,000
Shidao Bay CAP1400-1	SPIC	Shandong	SPIC	Q1'19	NA	NA	NA	1,400
Shidao Bay CAP1400-2	SPIC	Shandong	SPIC	H1'20	NA	NA	NA	1,400
Taipingling-1	CGN HPR1000	Guangdong	CGN	Dec 26'19	NA	2025	60-72	1,116
Zhangzhou-1	CNNC HPR1000	Fujian	CNNC	Oct 16'19	NA	2024	50-62	1,126
Zhangzhou-2	CNNC HPR1000	Fujian	CNNC	Sep 4'20	NA	2025	51-63	1,126
							Total MW:	8,368

Chinese Reactors Targeted for Commercial Operation After 2025

Reactor	Model	Province	Controlling Owner	First Concrete	Grid Connection Target	Commercial Operation Target	Months of Construction	Net MWe
Taipingling-2	CGN HPR1000	Guangdong	CGN	Oct 15'20	NA	2026	NA	1,116
Changjiang-3	HPR1000	Hainan	China Huaneng	Mar 31'21	NA	2026	NA	1,000
Changjiang-4	HPR1000	Hainan	China Huaneng	Dec 28'21	NA	Q1'27	NA	1,000
Linglong-1	ACP100	Hainan	CNNC	Jul 13'21	NA	NA	NA	100
Sanaocun-1	CGN HPR1000	Zhejiang	CGN	Dec 31'20	NA	2026	60+	1,117
Sanaocun-2	CGN HPR1000	Zhejiang	CGN	Dec 30'21	NA	2027	60+	1,117
Sanmen-3	CAP1000	Zhejiang	CNNC	Jun 28'22	NA	NA	NA	1,163
Tianwan-7	VVER-1200	Jiangsu	CNNC	May 19'21	NA	NA	NA	1,171
Tianwan-8	VVER-1200	Jiangsu	CNNC	Feb 25'22	NA	NA	NA	1,171
Xiapu-1	CFR600	Fujian	CNNC	Dec 29'17	NA	NA	NA	642
Xiapu-2	CFR600	Fujian	CNNC	Dec 27'20	NA	NA	NA	642
Xudabu-3	VVER-1200	Liaoning	CNNC	Jul 28'21	NA	NA	NA	1,200
Xudabu-4	VVER-1200	Liaoning	CNNC	May 19'22	NA	NA	NA	1,200
Haiyang-3	CAP1000	Shandong	SPIC	Jul 7'22	NA	NA	NA	1,163
							Total MW:	12,686

Source: Company filings and announcements; Energy Intelligence

At least one Spic official has acknowledged the inaugural CAP1400s are under construction, with first concrete poured at Unit 1 in the beginning of 2019 and at Unit 2 a year later. But the company has not provided a target date for their commercial operation, and the project remains shrouded in such secrecy that it doesn't appear to play a role in official tallies of reactors under construction. With that said, one environmental impact statement for the project points to a 56-month construction target for Unit 1 and a 50-month target for Unit 2, which would imply commercial operations for the twin units in fourth-quarter 2023 and second-quarter 2024, respectively.

Racing to Meet Ambitious Targets

CGN, meanwhile, has been struggling with delays across multiple newbuilds, and it may strain to accomplish its stated goal of bringing its three first CGN HPR1000s into commercial operation within the next 40 months: Fangchenggang-3 and -4 in Guangxi, and Taipingling-1 (also known as Huizhou-1) in Guangdong. The company announced in January that due to "certain impacts" from Covid-19, it had adjusted its schedule for both Fangchenggang units in order "to achieve a high-quality start-up and safe, stable operations." Unit 3 is expected to start operations in the second half of 2022, while Unit 4's start-up has been deferred until the first half of 2024, said CGN. Those dates imply a construction timetable of 80-84 months from first nuclear concrete pour to commercial operation for Unit 3, and 84-89 months for Unit 4.

That's in line with the schedule of Hongyanhe-6, CGN's most recently commissioned reactor, which began commercial operations on Jun. 23 some 82 months after starting construction in July 2015. Hongyanhe-6 is the last of CGN's four ACPR-1000s, the indigenous predecessor of the CGN HPR1000, and CGN saw the construction time of each ACPR-1000 grow successively longer, starting from an impressive 57 months for Yangjiang-5 in Guangdong. But the delays at Hongyanhe-6 and both of CGN's

first-of-a-kind HPR1000s at Fangchenggang augur poorly for improved construction times.

If CGN turns a corner and meets its more aggressive target for Taipingling-1 of 60-72 months, it will be in line with the average 71 months that CNNC took to build its first four CNNC-designed HPR1000s, including twin reactors near Karachi in Pakistan. But CNNC must significantly improve on that performance to meet its timetable for completing the Hualong-Ones under construction at Zhangzou-1 and -2 in Fujian, where it targets commercial operation in 2024 and 2025, respectively. That timeline, which is found in the company's 2021 annual report, implies construction times of 50-62 months for Unit 1 and 51-63 months for Unit 2. That compares to 68 months for its first HPR1000 in China, Fuqing-5, and 75 months for Fuqing-6, both in Fujian.

Of the 23 reactors currently under construction in China, only nine (including the two small Shidao Bay high-temperature reactors that feed into a single 211 megawatt turbine) are scheduled for completion during 2022-25. The mysterious twin-CAP1400 project, also at Shidao Bay, may add another 3 GW of gross capacity in that period, although Spic certainly has said nothing on the matter. If it did, that would leave 14 more newbuilds already in construction set for completion after 2025. Beijing has yet to announce any official targets for additional nuclear capacity beyond 2025.

Kim Feng Wong, Singapore

INTERVIEW

Bechtel's Tokpinar on Nuclear's Risks and Rewards

Bechtel has a storied history as one of the nuclear industry's leading engineering, procurement and construction (EPC) firms. In recent years it has helped US utility Southern Co. complete the twin AP1000s at Vogtle, in Georgia, while working with Westinghouse to pitch AP1000 newbuilds in Poland, the Czech Republic and the UK. On Aug. 10 Energy Intelligence's Phil Chaffee spoke with Ahmet Tokpinar, the head of Bechtel's nuclear operations, about his vision of Bechtel's role in nuclear newbuilds. The first part of this interview, below, has been edited for length and clarity.

Q: Over the past five years, we've seen multiple nuclear firms exit the nuclear space, and Westinghouse go bankrupt, all thanks to troubled newbuild projects. Given the extent to which Bechtel is talking up newbuilds in various markets, I'm curious why you want to be in this space. And where do you see profitability in newbuilds?

A: It's really the concern around climate change. I think there is recognition now that nuclear is the only baseload power without any carbon emission, compared to renewables that are intermittent. No one thinks there's one solution to achieving Net Zero by 2050. It's going to be a mix of different technologies. And we strongly believe nuclear's going to play a very significant role.

The second driver, which has grown more significant recently with Russia's invasion of Ukraine, is energy security. We talk to a lot of the governments in the UK, Eastern and Central Europe, which have relied heavily on Russian energy sources, and which intend to switch to nuclear, and work with Western technology. There is a significant nuclear opportunity in Europe, and the UK is in the same boat. They have been struggling, they're slow to make decisions, but they recognize the need.

The US market is a little different, as gas is more available and cheaper. I don't think there will be a large reactor build-out in the US in the next five years. But the US government's started this advanced reactor demonstration program under which they are providing significant funding — which is authorized and appropriated for the next five years — to two technologies, and we're partnering with one, TerraPower, on their Natrium design.

We've been in nuclear since the late 1950s. We built the first reactor in the US, in India, in different parts of the world, and we've never left this business for almost 70 years. And we have no intention of leaving. This industry is at the cusp of growing into a significant business for a lot of companies, including ours.

Q: And how can this be a profitable business for you?

A: It's all about what risk you take and how you manage and control that risk. In past projects, they [vendors] failed or created significant financial exposure, in part because they have signed up to a deal that they couldn't deliver. We understand the risks and we structure our contracting approach accordingly: we don't risk the company.

Q: Your biggest current nuclear project is at Vogtle. How have you structured that work, and what is Bechtel's scope there?

A: We were brought in, in mid- to late-2017, to take over construction and completion of the two units. We were brought in by Westinghouse prior to that to help them, and when they went bankrupt the customer — Southern — asked us to take over the construction. We are not involved in the design or supply of materials. Our scope is simply to finish construction.

Q: Is that model, that limited scope, what you're looking to replicate in other newbuild projects?

A: No. We are looking for an integrated engineering, procurement and construction model where we will work with the reactor supplier to integrate into an overall plan in a way that provides automation and allows tools and processes to work in an integrated fashion.

Vogtle was an anomaly for us. Ideally, we could have implemented our own automation tools that you need to manage a complex project like nuclear. It was more ad hoc. You come in the middle of your project, you do the best you can and you move the project forward. There's a lot of lessons learned, one of which is automation by which I mean engineering, procurement, construction tool integration: building an information management system in a data environment.

Q: In the integrated supply consortia you're envisioning, would you take the lead? Or would all the suppliers operate in separate tents, as we saw 10 years ago with Westinghouse and EPC provider Shaw in the initial phases of US AP1000 construction?

A: I see Bechtel playing a lead role in the integration aspect doing traditional engineering, procurement, construction. The reactor supplier provides their equipment and systems, and we integrate that into the overall program and plant.

But the model is not a turnkey EPC. It is [instead] the traditional way these plants were built in the US in the 70s and 80s, where you had a reactor supplier contractor with the owner and EPC contractor, and the EPC contractor is also the integrator of the reactor scope into the overall plant.

Q: And that's what you want to replicate now?

A: That's the vision. That's how I think these projects will be successful.

Q: Which newbuild markets are you most excited about?

A: We're very excited about Poland. They are getting closer to making a decision this fall. They will select the technology that they want to build. They have a large program laid out building 6-9 gigawatts of electricity.

A US government Concept Execution Report will go up at the end of August, and the Polish government will evaluate it and make a decision — I think sometime in October — whether they go with a US proposal. Both the Koreans and the French provided unsolicited offers. They're looking at those two and will make a decision. We hope to be the selected party to go build it.

Q: For the past year and a half, you and Westinghouse have been involved in a front-end engineering and design (Feed) study for Poland's nuclear program. This has now been submitted?

A: Yes, it was submitted in the first week in July. That report gets consolidated into the larger Concept Execution Report led by the DOE [Department of Energy] — and the Polish Ministry of Strategic Energy Infrastructure working with the climate ministry. They will complete this larger report that will touch on other aspects of collaboration in keeping with the intergovernmental agreement signed in February 2021, and that report is the final deliverable from the US side.

Q: And that report is basically equivalent to the bids submitted by Korea Hydro & Nuclear Power in March and by EDF last October?

A: They will consider it as such. I think the Polish government sees it as a US proposal, and recognizes that the US government doesn't operate the same way as the Koreans or the French. But it's the closest you can get to a USG [government] proposal.

Q: The Koreans have touted that they could offer a 30% equity stake in the project company. Is any equity stake in the project company on the table anywhere in Poland, the Czech Republic or the UK? And if so, is it anything on the scale of 30%?

A: I'll just make one generic comment. The US model is very different than the French or the Koreans, where state-owned companies can do things that US private partners can never match in the nuclear space. That creates a huge disadvantage for US nuclear technology companies, US EPC companies. We're not owned by the US government. The US government is not going to subsidize projects. The best they do is provide advocacy and support, and they've done a tremendous job.

I don't think there's any expectation that the US or the private market can ever match what a state-owned enterprise can do, and it distorts the playing field. What the Russians used to do, what the Chinese are trying to do. The French government and the Korean government, they have similar tools at their disposal.

Q: My understanding is that the US offerings might be better aligned with the demands of the Czech newbuild program, where the government has made clear they're not looking for supplier equity injections into the Dukovany II project company. Are you able to say anything about your expectations in the Czech Republic, where bids for Dukovany II are due by November?

A: We are participating together with Westinghouse. We hope that they will select us on the basis of a better technology. A company like ours can be bold, and improve the local supply chain and rely less on imports from other countries. We're very good as a company at identifying and working with local construction, contractors and suppliers, and bringing them up to par, and being able to do nuclear-grade work. And so when we leave [a project] behind, there's more capacity or capability in those companies [that we could bring] with us to the next project.

Both Poland and Czech Republic will benefit significantly from the way we approach projects, compared to our competitors, who mostly sent work back to their home countries to boost their exports.

Q: In such countries — and particularly Poland — there's not necessarily an experienced nuclear workforce. What is your plan for providing the skilled labor in these countries?

A: I think that's not true because Poland has an extremely skilled and productive workforce. Some of their workforce worked on nuclear projects in Finland, doing OL3 [Olkiluoto-3, the French-supplied EPR] construction, and some are working today in the UK on the Hinkley Point project [the twin EPRs at EDF's Hinkley Point C]. So they have experience.

The challenge in a country that doesn't have a nuclear history, though, is setting up the required training and orientation up-front, for the skilled laborers — skilled in their crafts and trades — who are coming in. Training on what is nuclear safety, what is nuclear quality. So when they step on site and start working, they have a very good understanding.

It takes time to set up a project, but that's what differentiates us. We would have a very robust training program so that all the skilled labor going through will have a good appreciation and understanding of what compliance is, what safety culture is, what nuclear quality requires. That's how we would approach it. But in terms of the skill level, whether it's electricians or welders, I think Poland is pretty good. It's one of the best in Europe.

Q: Moving to the UK, where there is a long nuclear history, what signals are you waiting for before really stepping up your new-build activity there?

A: The government needs to make a decision. We've been in discussions with the government almost three years, maybe closer to four years. We want to bring the AP1000 technology to Wylfa [on the island of Anglesey in north Wales], a site that we've worked for four years with Hitachi when they were looking to build their ABWR technology. They had to suspend the project and terminate. So we know the site, we know the area, we've done a lot of good design that is specific to the site, as opposed to the technology.

It's really up to the UK government. They've taken some positive steps: setting up the Great British Nuclear organization, they have this future nuclear-enabling fund that will issue applications for grants. We have everything ready, waiting for them to take the next step, to send in an application, apply for funds, start a Feed [study] similar to what we've done in Poland. We hope Great British Nuclear will be up and running, and will be able to select projects that are mature enough and ready enough that they can finance either under a revised Rab scheme [the recently codified Regulated Asset Base scheme that allows cost recovery from ratepayers during the construction period], or government guarantees.

The private sector is not going to come in with billions of dollars and fund these projects until a final investment decision [FID]. It has to be the UK government. We're providing feedback on their solicitations on the Rab model and others. They know what to do. If they take the right steps, we can get them there. They've set very ambitious targets to get to 24 gigawatts [of new nuclear power capacity] by 2050.

But we need to start today. We needed to start yesterday. To get there, you're not going to build these plants in five years. I think they recognize the urgency, and if they take the appropriate actions we can help them get there. It's not going to be one technology, I think this Great British Nuclear needs to decide how many large, how many small [reactors], so that there's a mix of technologies that can be deployed over time. Not all are ready. We are ready with the Westinghouse technology, to bring Vogtle Unit 4 as a reference design.

Q: Hitachi spent £2 billion-£3 billion ($2 billion-$4 billion) on that pre-FID development before pulling out. Would you be willing to fund any pre-FID work out of your own pocket?

A: Look, the amounts you're talking about, no private company could invest without backstop from the government. Hitachi is very large, and they got burned because they had to walk away with 2.5 billion — whatever the number was — sunk. No one's going to repeat that.

The amount you're talking about is big, and it's government's role. You don't look at nuclear to be as competitive as building wind or solar, you do it for more strategic reasons: climate change, energy security. And since we're not able to price the cost of those two drivers, on paper it looks expensive, and it is. But when you can factor in the security you get from having nuclear energy 24/7 available without relying on any gas, and you add the carbon-free attributes, it is a far better alternative.

Q: To what extent are you watching EDF's progress at Sizewell C, the planned twin-EPR newbuild in southeast England, and EDF's attempt to get to an actual FID. If they fail to get to an FID, will that be a signal to pull out of the UK market?

A: I don't think whether they succeed or not is going to be an indication of whether there's a market or not. They have a different technology, a different approach.

What's critical to us is, are they [the British] serious and committed to building nuclear plants? Are they going to stand behind it? And if the answers to these are Yes and Yes, we will be there. If they don't want to fund the Sizewell project for different reasons — because they may think it's not a good match, the deal is not going to work out, whatever the reasons — they're not changing their commitment. But if they come out and say "We don't want to build any more nuclear plants," then we're gonna go, there's no reason to be there.

Q: So we've talked about three markets where you're partnered with Westinghouse to bring to the market additional AP1000 projects: Poland, the Czech Republic and the UK. Are there are other markets?

A: There are other markets and I think there will be others following, but not happening at the same time. There are discussions, but I think that Europe as a whole can only build so many of these.

Q: What about outside of Europe, markets like Saudi Arabia or India?

A: India has challenges. The nuclear liability regime and the law is not to our comfort level, and I think it's a well-known fact for Western companies: until they change that, or the government is willing to provide certain indemnities, I don't see us working there.

Saudi … we're a US company, there has to be a 123 Agreement [a civil nuclear cooperation agreement, over which talks between Washington and Riyadh have stalled]. Once that's in place, then we're more than happy to work in Saudi. We've been there for 75 years.

Q: One final question on your relationship with Westinghouse. Is Bechtel considering purchasing Westinghouse from its current owner Brookfield?

A: We don't own technologies. We're not in the business of acquiring technologies, especially that size. It's not our business model.

Q: To what extent can any of these projects move forward when the future ownership of the main technology provider is up in the air?

A: I don't see the sale of Westinghouse as creating any uncertainty in the market. It's a good design, good technology, they have a very good model of doing business. We're not concerned. I don't know that the customers are concerned.

Next week we will publish the second half of this interview which focuses on Bechtel's work in the advanced reactor sector.

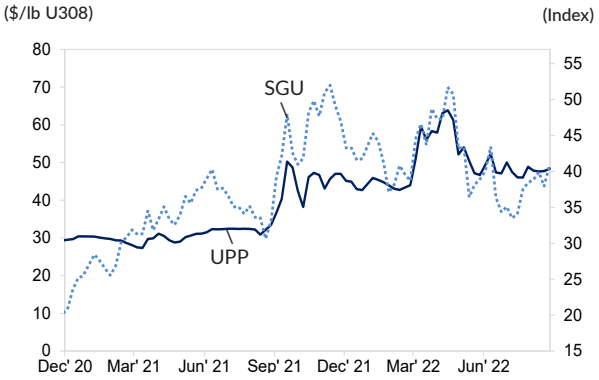
Phil Chaffee, New York.

URANIUM MARKET UPDATE

All prices as of Thursday, August 25, 2022

UPP VS. SOLACTIVE GLOBAL URANIUM INDEX

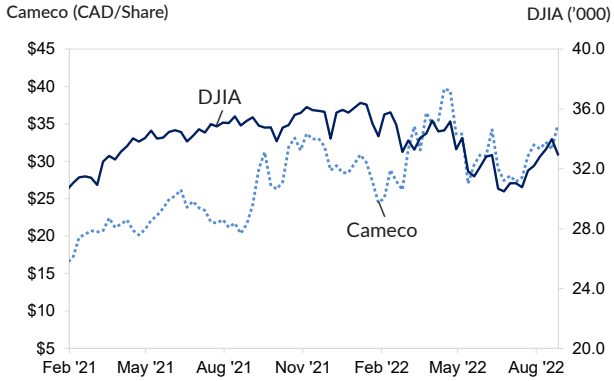
(previous 52 weeks)



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

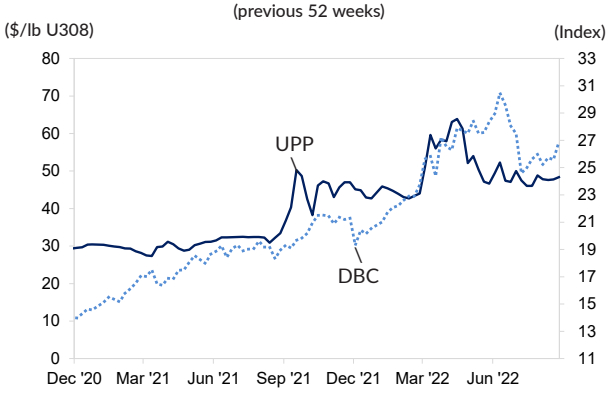
(previous 52 weeks)



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

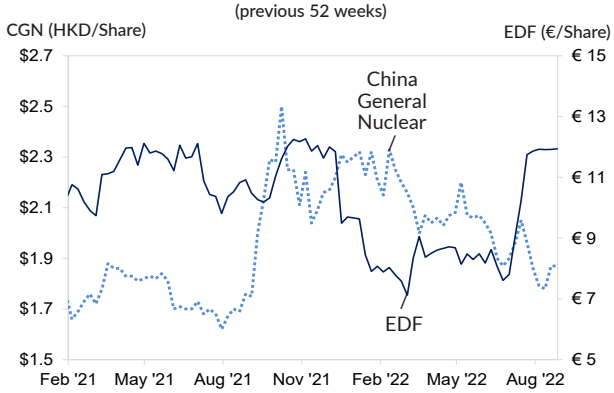
(previous 52 weeks)



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

		2022							2021				
	Chg.	Jul	Jun	May	Apr	Mar	Feb	Jan	Dec	Nov	Oct	Sep	Aug
Uranium ($/lb U3O8)													
Low	-	45.50	45.50	46.00	52.50	51.00	42.50	43.00	42.00	43.00	36.00	36.00	32.20
High	-2.00	50.50	52.50	54.00	64.00	60.00	44.50	46.50	47.00	47.50	48.00	51.00	36.00
Conversion ($/kgU)													
Low	+2.00	32.00	30.00	30.00	28.00	26.00	16.00	16.00	16.00	15.00	16.00	19.00	19.00
High	+4.00	37.00	33.00	33.00	30.00	28.00	17.00	17.00	17.00	18.00	19.00	21.00	21.00
Enrichment ($/SWU)													
Low	+5.50	89.50	84.00	84.00	82.00	100.00	59.00	57.00	56.00	56.00	55.50	55.50	54.00
High	-55.00	95.00	150.00	150.00	150.00	150.00	61.00	59.00	57.00	57.00	57.50	57.50	56.00

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.