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# NUCLEAR INTELLIGENCE WEEKLY®



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As "a few motivated sellers" struggled to find buyers, Energy Intelligence's Uranium Price Panel delivered an average price assessment of $51.20 per pound U3O8 on Nov. 3, down by more than $1/lb. from last week.

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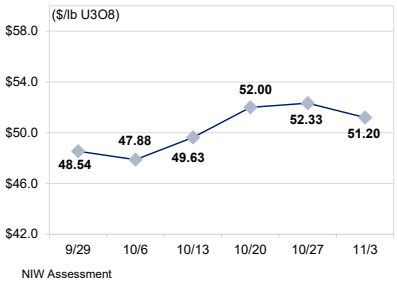
After months of silence on the request for indicative proposals first issued this summer, Slovakia's Slovenske Elektrarne has informed certain suppliers that they have entered the second round of evaluations.

UPP: $51.20/LB U3O8




WEEKLY ROUNDUP

# EDF Concludes Discounted Nuclear Turbine Deal with GE

- France's EDF is one step closer to acquiring GE Steam Power's nuclear activities, apparently after negotiating a discount to the previously reported price of €1.2 billion ($1.3 billion). The new binding agreement follows the signing of an exclusive agreement in early February, but may involve a 10%-20% discount from the previous "enterprise value" due to "sanctions risks", according to the *Financial Times*. This discount reflects a reliance on Russia's nuclear newbuild plans for some 60% of the order book of the division, which is centered in the French city of Belfort. News reports from earlier this year had indicated the prior deal would include GE receiving €273 million in cash from EDF, €73 in liabilities assimilated to debt, and another €900 million in advance customer payments. GE said in a Nov. 4 statement it expects the transaction to close in the second half of 2023, subject to regulatory approvals. The deal includes the manufacturing of conventional island equipment, including steam turbine technology, for nuclear newbuilds, and reactor services for existing plants in all regions other than the Americas.

- US operator Constellation, formerly of Exelon, announced this week it is seeking approval to operate its Dresden-2 and -3, and Clinton-1 reactors for another 20 years, supported by state and federal subsidies. The plants are among three other Constellation plants that benefit from two Illinois subsidy programs. Illinois' zero-emission credit program allows Clinton-1 and Quad Cities-1 and -2 to collect a surcharge on electric bills statewide until 2027. After the operator in 2021 threatened to close its Byron, Dresden and Braidwood plants, Illinois lawmakers passed a new subsidy program providing little less than $3 per megawatt hour over five years to the three plants. Now with the $30 billion in federal nuclear production tax credits that take effect in 2024 and expire at the end of 2032, Constellation has signaled it is evaluating extending the life of all 21 of its merchant reactors. And while Clinton stands to benefit from both the initial state credit program until it expires in 2027 and the federal credits, the 2021 state subsidy program requires subsidy reimbursement in the event of federal support, so Dresden may not be able to benefit from both.

- During a Oct. 28 visit to the Krsko nuclear power plant, a 688 MW Westinghouse-supplied pressurized water reactor, Slovenia's Prime Minister Robert Golob cited the European energy crisis as he touted the "possibilities of nuclear technologies in the future," according to an Oct. 28 government statement. Once "experts arrive at a serial solution for nuclear technology of Western origin," the government wants "appropriate technical solutions" to be prepared, with "all necessary permits and approvals" obtained, at which point it will put the issue to the general public in a referendum. Meanwhile in Sweden, where a new government is promising an enormous legal, financing and regulatory push to incentivize new nuclear, German utility Uniper is considering building a new nuclear plant near its decommissioned Barseback reactors, a Uniper official told local television news. This would be as part of a "Clean Energy Park" including wind and solar power and hydrogen production.

NUCLEAR FUEL MARKET

# Spot Uranium Price Dips

The spot uranium price slipped lower this week as "a few motivated sellers" struggled to find buyers at around $50 per pound U3O8, according to market sources. That coincides with Sprott Asset Management's uranium trust (Sput) taking a step back from the market this week, as the fund's movements continue to weigh heavily on the spot uranium market.

With a return to uranium spot market illiquidity in the first week of November, Energy Intelligence's Uranium Price Panel delivered an average price assessment of $51.20/lb. U3O8 for Thursday, Nov. 3, down from $52.33/lb. U3O8 last week.

Trading activity continues to dominate market activity with some traders motivated by price adjustments in existing offtake contracts and investors and investment funds looking to procure.

Sput procured 500,000 lbs. U3O8 in October as prices rose from $47.50/lb. to $52.75/lb. through the month. But this week its share price once again dipped below its net asset value, putting the brakes on buying activity because it legally can't raise cash from investors under those circumstances. That drop in Sput's share price seems to be the result of wider market fundamentals, including massive corporate layoffs, signaling an economic downturn.

For nuclear power plant operators, the spot price dip seems to be encouraging more U3O8 buying, although this is occurring quietly with a heavy preference for nondisclosure. This preference is understandable given the large influx of investors over the past couple of years—any public news about nuclear fuel deals could spur an investor buying frenzy, crowding out further opportunities for utilities.

Indeed investor sentiment may have helped sustain prices above $52/lb. last week after Cameco reported it was finalizing contracts for 27 million lbs. U3O8, with 50 million lbs. already in its order book. But volatility in the uranium price doesn't always translate to the rest of the front-end fuel cycle.

In the conversion market, prices have more than doubled from year-ago levels to $40 per kgU today, with at least one deal transacting at this level over the past month. That might be largely reflective of growing UF6 tightness given production troubles at Orano's Philippe Coste conversion plant (otherwise known as Comurhex II) at Tricastin in southern France. Orano has been borrowing UF6 from Cameco and buying spot market material where it can, according to sources, likely to replace lost output.

Enrichment prices also continue climbing, with current transactions at $93-$96 per separative work unit (SWU) from about $56/SWU this same time last year; this largely owes to a shift in long-term demand away from Russia.

In Eastern Europe, Slovakia's Slovenske Elektrarne is apparently still looking for indicative proposals for all components, seeking to diversify away from Russia. After months of silence on the request issued this summer, the utility recently notified certain suppliers that they have entered a second round of evaluations.

Western suppliers are hoping to add Slovakia and Bulgaria to the list of customers, including the Czech Republic, Ukraine, and Finland, that have been traditionally reliant on Russian nuclear fuel supply. But there appears to be some reluctance given rising prices for enrichment and conversion services in the West.

This move away from Russian supply is prompting both Urenco and Orano to switch from underfeeding to overfeeding, which means they will require more UF6 from customers, thus putting more upward pressure on UF6 prices.

But higher contracted enrichment prices should also underpin investment by both enrichers in new centrifuges, allowing higher levels of production, and that would eventually allow utilities to lower their tails assays, thus reducing overfeeding and rebalancing the UF6 market. But until those investments are made and as long as the bifurcation of the Western nuclear fuel market from Russia persists, UF6 supply is likely to be tight.

*Jessica Sondgeroth, Washington*

## URANIUM PRICE PANEL

*For the week ended November 3, 2022*

Weekly Spot Market Prices

| | | Oct | | | | | Sep | | | | | Aug | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chg. | 3 | 27 | 20 | 13 | 6 | 29 | 22 | 15 | 8 | 1 | 25 | 18 | 11 |
| Price ($/lb U3O8) | -1.13 | 51.20 | 52.33 | 52.00 | 49.63 | 47.88 | 48.54 | 49.82 | 50.03 | 51.83 | 52.50 | 48.38 | 47.75 | 47.63 |
| *Total Assessments* | *-1.00* | *8.00* | *9.00* | *10.00* | *12.00* | *9.00* | *8.00* | *10.00* | *10.00* | *8.00* | *8.00* | *9.00* | *10.00* | *9.00* |
| *% within 1 StDev* | *-4.17* | *62.50* | *66.67* | *70.00* | *83.33* | *77.78* | *87.50* | *60.00* | *70.00* | *75.00* | *62.50* | *77.78* | *80.00* | *77.78* |
| Low ($/lb U3O8) | -1.90 | 50.00 | 51.90 | 51.50 | 49.00 | 47.50 | 48.25 | 49.00 | 49.00 | 51.25 | 52.00 | 48.00 | 47.50 | 47.25 |
| High ($/lb U3O8) | -0.80 | 52.20 | 53.00 | 52.50 | 50.50 | 48.25 | 49.00 | 51.00 | 51.00 | 52.00 | 53.50 | 49.00 | 48.25 | 48.00 |
| Variability* | 0.51 | 0.62 | 0.11 | 0.25 | 0.75 | 0.07 | 0.08 | 1.00 | 0.38 | 0.19 | 0.39 | 0.38 | 0.25 | 0.04 |

*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

# AP1000 Selected for First Nuclear Plant

The Polish government settled this week on AP1000 technology for the first nuclear power plant in the country's official government newbuild program, with the prospect of three AP1000s to be ordered and built at the Lubiatowo-Kopalino site on the Baltic Sea. The selection was first announced on Twitter by Prime Minister Mateusz Morawiecki on Oct. 28, and then confirmed in a Nov. 2 Council of Ministers resolution.

A 3.75 gigawatt nuclear plant will be built using "the proven and safe American technology of AP1000 reactors," said that resolution, with the first of three reactors to be completed by 2033. Meanwhile "immediate measures" will be taken "to prepare and implement" the construction of Poland's second large-scale nuclear power plant. In a separate statement Climate Minister Anna Moskwa announced construction of the AP1000 plant will start in 2026, and said "we remain open to cooperation with European and global industry, also in the context of building a second nuclear power plant in our country."

All of this is far away from any commercial deal, and to meet that 2026 goal Warsaw must move fast on any number of fronts — from legislating a financing framework for new nuclear, to building out human resources capacities, to negotiating robust commercial contracts with Westinghouse, a constructor (likely Bechtel) and supply-chain firms. And much of this, from the selection to the financing, must then be reviewed in Brussels.

Further muddying the waters is a parallel deal announced by Deputy Prime Minister Jacek Sasin, who also heads the Ministry of State Assets, and whose nuclear ambitions appear entirely separate from those of the Climate Ministry, which is spearheading the official government nuclear program. In short, Sasin's deal, announced during a visit to Seoul, doesn't appear to be the "second" plant referenced by Moskwa or the Council of Ministers. The deal is in a letter of intent between Korea Hydro & Nuclear Power (KHNP), Polish state-owned utility PGE, and private Polish coal company ZE PAK to build an APR1400-based nuclear plant at the inland Patnow site currently home to a ZE PAK coal-fired plant.

## A Political Process

Both KHNP and EDF submitted "uninvited" bids to supply the official newbuild program, but faced an uphill battle against a Bechtel-Westinghouse consortium which has been in pole position since an October 2020 US-Poland nuclear energy intergovernmental agreement (IGA) paved the way for early work on the nuclear program by the two firms. That followed a separate 2019 US-Poland nuclear cooperation memorandum of understanding, and was part of a process developed under the Trump administration to echo Moscow's strategy of winning nuclear export business via bilateral government agreements.

Seoul attempted to counter this strategy by offering a compelling commercial proposal with its APR1400 technology and abundant equity financing offered to Warsaw. "The Korean proposal was by far the best in terms of economics from the three that Poland got," one Polish industry source told Energy Intelligence. But "Korea has nothing to offer in terms of geopolitics," and Poland "cannot be independent or neutral" — it needs Washington's support. The Korean offering, to say nothing of the French offering, was "not a solution for us in terms of security of the country."

But Warsaw's decision to select a technology without a competitive tender opens it up to pushback both in Brussels, where a European Commission review is likely, and at home, where the right-wing Law and Justice party must defend its majority in parliamentary elections on or before Nov. 11, 2023. "EU law requires the so-called competitive procedure in which there must be several bidders," Leszek Miller, a former prime minister who now serves as an MEP in one of Poland's larger opposition parties, wrote in a Nov. 2 opinion piece. "Everyone needs to know the purchasing process before it starts and everyone must be treated the same way."

It's still possible that KHNP or theoretically EDF could be selected for the second government-sponsored nuclear project, as Moskwa hinted. For its part EDF "takes note" of the Polish decision, the French company said in a statement provided to Energy Intelligence, and "regrets that its preliminary offer, based on EPR technology, 100% European, was not discussed for this first site in a competitive process where the technical, industrial, commercial and financial aspects would have prevailed." EDF said it "is maintaining its integrated offer for the Polish nuclear program" and it "calls for the establishment of cooperation agreements at political and industrial levels as soon as possible."

## Washington Crows in Victory

Warsaw's decision to go with the AP1000 appears to validate Washington's effort to circumvent any public tender process. The Polish project "can serve as a template for future project development in the region," the US Department of Energy said in a Nov. 3 statement touting a $40 billion figure for the project — "one of the largest civil nuclear projects ever awarded to US industry and the first since 2007." Separately, US Vice President Kamala Harris tweeted the project will "address the climate crisis, strengthen European energy security, and deepen the U.S.-Poland strategic relationship."

Much remains to conclude, however: Westinghouse and Polish state-owned project company Polskie Elektrownie Jadrowe (PEJ) "must now negotiate their commercial arrangement, and there is a great deal more engineering work which can now move forward," the US embassy in Warsaw said in a Nov. 2 "fact sheet" on the deal. Washington "encourages PEJ to select Bechtel as the engineering, procurement and construction [EPC] contractor for the project," said

the fact sheet, which further noted that the US government "will remain engaged to follow through on financing commitments."

The Polish Climate Ministry said that the Concept and Execution report jointly developed by US and Polish officials "indicated potential sources of financing for the project, including the involvement of US government institutions, i.e. Export-Import Bank of the United States and US International Development Finance Corporation."

There's still no sign of a Polish government plan on how to enable financing, and mechanisms such as a long-term power purchase agreement, a contract-for-difference or a regulated asset base model would likely take years to codify.

The related and fundamental issue of construction risk is also not resolved. "The ultimate cost of what's on the table is going to be untenably high," one senior US industry source told Energy Intelligence. Westinghouse is likely to avoid any serious equity stake in a project company, and will attempt as much as possible to restrict its offerings to technology supply for the nuclear island.

If Bechtel is selected for EPC it will likely insist on a "time and materials-type contract" similar to its scope completing the Vogtle AP1000s in the US. "Nobody" on the US side "will be taking any delivery risk," said the source. While at this point AP1000 equipment costs are "understood", Bechtel's scope in particular, and the project construction costs, will be "the highest uncertainty."

*Phil Chaffee, London*

NEWBUILD

## Behind KHNP's 'Unofficial' Polish Project

This week's letter of intent by Korea Hydro & Nuclear Power (KHNP) to supply APR1400s to a site in Poland was surprising for several reasons, the first of which is the Korean firm's counterparty: not the government-owned project company Polskie Elektrownie Jadrowe (PEJ) explicitly set up to launch Poland's first large reactors, but rather ZE PAK, a power company with three lignite-burning plants, majority-owned by Polish telecoms billionaire Zygmunt Solorz-Zak.

The second surprise was the location of the mooted project: ZE PAK's inland Patnow site, currently home to the company's largest plant, where in August 2021 ZE PAK had agreed to build up to six GE-Hitachi BWRX-300 small modular reactors (SMRs) with Synthos Green Power, the offshoot of the chemical group owned by Polish billionaire Michal Solowow. Instead, ZE PAK revealed in an Oct. 31 note to shareholders that it had terminated that agreement due to its "intention to conduct further analyses regarding the possible, different and more diversified use" of the site.

The final surprise was that the deal was announced in Seoul by Deputy Prime Minister Jacek Sasin, a rival of Prime Minister Mateusz Morawiecki, and also included state-owned PGE, Poland's largest utility. PGE owned 70% of PGE EJ1, the nuclear project company bought out by the government in 2020, possibly because PGE and the other parastatal companies that had been induced to take a stake made clear their reluctance to invest in a newbuild program. It's not clear to what extent PGE was again brought to the table kicking-and-screaming: Sasin also heads the Ministry of State Assets, and therefore has direct control over PGE.

In recent years Sasin's ministry appeared to be pushing its state-controlled industrial companies to sign memoranda of understanding with SMR vendors, even after the government's main nuclear program headed by the Climate Ministry discarded SMRs for lack of technical readiness. But ZE PAK's move away from SMRs, and Sasin's involvement in the deal, may signal that the SMR luster has faded even further in Poland. Many of Poland's industrial companies "are coming to the conclusion that the SMRs are interesting, but the time perspective is too long for them to wait," explained one Polish industry source to Energy Intelligence.

KHNP, ZE PAK and PGE will work to complete a basic feasibility study by year's end that will include a geotechnical, seismic and environmental analysis of the Patnow site. The study will also include budget estimates for each phase of the newbuild — including pre-construction, construction, and operation — according to a "mutually proposed financing model", the South Korean Ministry of Trade, Industry and Energy said in an Oct. 31 statement.

Just as with the government's official newbuild project, that financing model is far from clear. But KHNP and the Korean government have made clear that they will bring considerable financing muscle — including large equity investments — to bear, and they may be willing to adopt construction risk in a way their US rivals aren't. PGE, meanwhile, is unlikely to bring much to the table beyond willingness to help interface with regulators and grid operators as an experienced utility. Which then leaves Sasin and Solorz-Zak, and the extent to which they can bring state or private capital to the project.

*Phil Chaffee, London*

CORPORATE

## Westinghouse Sues Kepco/KHNP

Westinghouse's bombshell lawsuit against South Korea's top nuclear firms is an unprecedented legal move to defend nuclear intellectual property, and a blow to the longstanding bilateral civil nuclear relationship between South Korea and the US. The key question now is whether the move against state-owned Korea Electric Power Co. (Kepco) and its subsidiary Korea Hydro &

Nuclear Power (KHNP) will derail South Korean reactor export efforts to key markets, including Poland, the Czech Republic and Saudi Arabia.

In a lawsuit filed Oct. 21 in the US District Court for the District of Columbia, Westinghouse argued that the APR1400, like the two other extant South Korean large reactors designs — the APR1000 and OPR1000 — are "derived from, based on, and incorporates technology" licensed to Kepco/KHNP by Combustion Engineering (CE), the former US-based nuclear vendor absorbed into Westinghouse nearly two decades ago.

Westinghouse argues that any effort by KHNP or Kepco to build these designs in third countries — or even to deliver "technical information" in response to technology tenders from such countries, as KHNP has done in Poland and intends to do in the Czech Republic and as Kepco intends to do in Saudi Arabia — "constitutes a retransfer" of the technology licensed by Westinghouse under Part 810 of the US government's code of federal regulations, and therefore requires a Part 810 authorization from the US Department of Energy (DOE). As the "licensor" of the technology, Westinghouse "is legally responsible for compliance with Part 810 for its foreign licenses," the lawsuit states.

As relief Westinghouse is asking for a legal declaration that the Korean designs in question, "including APR1400 and APR1000", all "constitute Controlled Technology under Part 810." Such a declaration could give Westinghouse an effective veto over KHNP and Kepco offerings into foreign reactor markets — allowing it either to block them entirely, or to force the Korean vendors to grant commercial scope to Westinghouse in their supply deals.

That assumes, however, that Seoul respects any such legal ruling. The DOE has no obvious mechanism to directly enforce a US court decision overseas, but Westinghouse may be counting on Washington's clout in Seoul to backstop such a decision through other means.

For their part Kepco and KHNP said in a joint Oct. 25 statement that they "plan to seek out the best countermeasures so that there is no setback in the export of nuclear power plants."

## Awkward Relations?

The lawsuit comes at a complicated time in US-South Korean relations over commercial nuclear power, with both governments backing aggressive reactor export efforts. But it also reflects something gone badly awry between Seoul and Washington, and arguably within South Korean's relatively new government. However, given the decades of mostly subterranean tensions over the deployment of the US-origin reactor technology by the two South Korean firms, it's also not terribly surprising.

From a legal perspective, the issue centers on a 1997 technology transfer agreement related to the export of Combustion Engineering pressurized water reactor technology for Units 3 and 4 at Hanbit, then called Yeonggwang. This covered "intellectual property and other technical information relating to CE's pressurized water reactor technology and System 80+ nuclear power plant design," which Westinghouse acquired when it purchased CE's nuclear division in 2000. That technology became the basis for South Korea's OPR1000 and APR1400.

The first big test came when Abu Dhabi launched its nuclear program, and Kepco and a broader Korean consortium competed and, in December 2009, won a deal to supply four APR1400s to Barakah. Westinghouse didn't directly compete for that work, and instead concluded a deal in March 2010 to work with the Korean firms on reactor exports and to provide technology and equipment for the project based on DOE Part 810 approvals.

In an August 2012 Barakah-specific "licensing support agreement", the parties agreed that the APR1400 "incorporated Westinghouse-owned Licensed Technology" and that Part 810 authorizations were required to export that technology out of South Korea. These authorizations required semi-annual reports to the DOE for which KHNP and Kepco "provided Westinghouse a list of at least twelve documents related to design specifications that Defendants themselves identified as derivative technology subject to Part 810," Westinghouse argues in the lawsuit.

## Fractured Relations

The 2010 deal expired two years ago, however, and it did so in a much-changed environment. Westinghouse is controlled by a private equity firm perhaps unconcerned with the intangible impact of a deteriorating long-term relationship with the Korean nuclear industry, while Kepco and KHNP were prompted by a government opposed to domestic nuclear to focus all their energy on nuclear exports.

There were some steps forward in the US-Korean bilateral relationship, including a deal struck with Washington in May 2021, under the prior administration of President Moon Jae-in, pledging US-Korean cooperation in overseas markets via "coordination in the supply chain".

This has been undermined by subsequent developments. The Ministry of Trade, Industry and Energy, which oversees both Kepco and KHNP, is in the driver's seat on the Westinghouse intellectual property issue, and may be relatively unconcerned about the bilateral relationship with Washington. Energy Intelligence understands that the Ministry of Foreign Affairs felt blindsided when it learned about the lawsuit.

It's difficult to know how things will play out from here. Considering that the 2021 bilateral agreement also contained a commitment by both sides to limit reactor deals to countries adhering to the International Atomic Energy Agency's Additional Protocol, nonproliferation officials in both Seoul and Washington may be at a loss over what comes next. There is also the matter of research and development cooperation between the Korea Atomic

Energy Research Institute (Kaeri) and DOE's national laboratories, where Energy Intelligence understands there is already a chill. Following the rupture of the Seoul-Washington civil nuclear relationship, it looks like any further cooperation is on ice.

*Phil Chaffee, London*

GERMANY

# Bundestag to Vote on Reactor Extensions

Next week German lawmakers will debate and then vote on the government's plan for extending operations at Germany's final three operating reactors until Apr. 15. The bill's passage will amount to a ceasefire in this year's debate over nuclear power in Germany but potentially open the road to renewed debate over the issue with an uncertain outcome.

Much is at stake in the hearings before the German Parliament Environment Committee set to commence Nov. 9. A fragile compromise worked out by the three-party coalition government in a draft law would amend Germany's Atomic Energy Act to allow for extended operations at Emsland, Isar-2 and Neckarwestheim-2 nuclear power plants through Apr. 15. That is already being challenged by the pro-nuclear Christian Democratic Union (CDU) and Christian Social Union in Bavaria (CSU) opposition parties, which have advanced alternative legislation to allow the three plants to operate through the end of 2024. The opposition bill will almost certainly fail when the Bundestag votes on the two measures Nov. 11 since the sponsors lack a parliamentary majority, but the issues raised in the debate aren't likely to disappear.

The government's compromise proposal will result in a relatively modest 5.4 gigawatts of additional power through Apr. 15 assuming all goes according to plan, according to a government explanatory note dated Oct. 18. Emsland should be able to operate until the end of January with its current reactor core, after which it would shut down for about two weeks to reconfigure the core and then operate at reduced power until Apr. 15, with total output over the extended period estimated at 1.7 TWh, the note explained. Isar-2 can operate after the end of the year at reduced power until about the beginning of March, producing about 2 TWh of power. Neckarwestheim-2 will also produce about 1.7 TWh of electricity, after shutting down at the end of the year for 2-3 weeks to reconfigure its reactor core and then operate at reduced power until Apr. 15.

In line with the CDU/CSU opposition push for a longer extension, the only pro-nuclear party in the three-party governing coalition, the Free Democratic Party (FDP), this year has argued in favor of more nuclear power generation. Increasingly over the last six months the ruling Greens, Social Democrats, and the FDP have fallen out over their management of the economic and energy supply crises. So far there is no sign that the government would collapse, according to Mark Hibbs of the Carnegie Endowment in Berlin. "But should the coalition be seriously threatened by internal discord, the FDP and the CDU/CSU may be lifted by opinion polls that now say that a growing majority of Germans favors nuclear power."

There is also the question of the "balancing of interests" as outlined in Germany's Basic Law, which will almost certainly be tested in the courts. This holds that the risks posed by nuclear energy "to the life and physical integrity of citizens, and the burdens imposed on future generations by radioactive waste, are justifiable only if they are acceptable as the result of a comprehensive weighing of interests," according to Christoph Pistner, head of nuclear engineering and safety at Germany's Öko-Institut.

Before any vote or court cases, however, next week's hearings promise contentious discussion over the proposed nuclear extensions, and are likely to highlight the impact of the French nuclear crisis over demand for German electricity and the stability of the German grid. Beyond that there is the potential for the legislation setting what nuclear opponents view as a dangerous legal precedent, and questions of nuclear safety, adequate staffing and other technical, legal and regulatory issues at plants that had been set to permanently retire by Dec. 31. "A license to extend the German reactors is no production guarantee," says Mycle Schneider, a Paris-based international analyst on energy and nuclear policy.

## No Fallback in France

Some pro-nuclear advocates center arguments in favor of the extended operations around the need for German energy security in the wake of the Ukraine crisis and a cutoff in Russian gas supplies. Nuclear opponents argue that the primary driver is not energy security for Germany but for France where EDF is struggling to bring more than half its fleet back online. "The issue is the French grid, not the German," Schneider told Energy Intelligence in an email.

This issue of France's flagging nuclear performance — this year's output is expected to fall below 300 Twh hours for the first time since 1990 — was prominent in a second grid stress test undertaken by Germany's four grid operators on behalf of the Federal Ministry for Economic Affairs and Climate Action. This provided part of the rationale in early September for putting two reactors — Isar-2 and Neckarwestheim-2—on "cold reserve" for possible use through mid-April. That plan was amended last month to allow not just two, but all three remaining, plants to operate through Apr. 15, representing a victory for the FDP.

The stress test results published Sep. 5 suggested that the French fleet was important to maintaining "redispatch capacity" to Germany and thereby avoiding grid congestion. This "redispatch capacity" is a planning response to address one of the fundamental problems with Germany's Energiewende: a grid expansion

insufficient to match the supply of growing renewable energy capacities in northern Germany with the demand from industrial centers in southern Germany. Planners therefore developed the concept of "redispatch" power stations with the spare capacity to "quickly provide the German market with electricity to offset grid congestion," the economic and climate ministry explained in a Sep. 5 press release.

Tackling this congestion required "redispatch" nuclear power stations located outside Germany to the tune of 4.6 GW and "it is extremely uncertain whether this power plant capacity can actually be provided by our European partners." Therefore, what is needed to avoid grid congestion is "a package of precautionary measures" basically aimed at improving grid reliability and supply, the ministry explained. "The findings show that keeping the three nuclear power plants available can only be of limited assistance for the electricity grid in stress situations." In a "very critical scenario, having all three nuclear power plants in operation would reduce the need for foreign redispatch power stations not by the nominal capacity of the three plants, but only by 0.5 GW," the statement said.

For the time being, however, there's little chance of Germany being able to rely on imported French kilowatts. "As I'm writing, there are less than 29 GW nuclear in the French grid. Installed nuclear capacity is more than 61 GW," Schneider wrote in his email. And on Thursday, Nov. 3, EDF revised downward its 2022 French nuclear output estimate to 275-285 TWh, compared to the previous estimate of 280-300 TWh. The estimate reflects the "impact on maintenance schedules of strikes movements in autumn 2022" and outage extensions at four reactors involved in stress corrosion inspections and repairs, EDF said.

*Stephanie Cooke, Washington*

SAFETY

# PG&E Resubmits License Renewal for Diablo

Pacific Gas and Electric (PG&E) on Oct. 31 asked the US Nuclear Regulatory Commission (NRC) to resume its review of a previously withdrawn license renewal application (LRA) to extend the operating lives of Diablo Canyon-1 and -2 beyond 2024 and 2025. That's a controversial ask, according to nuclear safety experts, given the breadth of operational changes and decisions that have been made since, and several more recent unplanned outages related to equipment failures.

The LRA request comes after the California legislature on Sep. 1 voted overwhelmingly to provide the 2,256 megawatt Diablo Canyon nuclear plant a $1.4 billion forgivable loan to keep the plant operating for five more years until 2030. The state's about-face policy change gives PG&E a very small window to get the regulatory approval needed to extend the plant's operating life, not to mention the myriad technical challenges involved in reversing years of maintenance and operational planning around the plant's closing.

PG&E had actually begun a license renewal process in 2009, and in 2011 NRC staff issued a safety evaluation report. NRC staff were in the process of other technical reviews when PG&E in 2016 requested a suspension of activity before withdrawing the application two years later, saying that the units were no longer needed to meet California's projected energy requirements. Now PG&E, in its request to the NRC, is asking the agency to pick up where its previous license renewal effort left off.

PG&E notes that the NRC had previously commenced "the Advisory Committee on Reactor Safeguards subcommittee meeting and completed the environmental scoping and audit process," and "rather than discarding the entirety of the NRC's extensive prior review, analysis and work product, the goal of prudent and efficient use of agency resources is best served by continuing the review where it left off and leveraging the existing evaluations to the fullest extent possible."

## Reversing Course

But for nuclear safety experts, that argument "seems to miss on a very key change in the intervening years: between 2016 and 2022, Diablo Canyon was operated with the idea that the facility would be shut down in 2024-25," M. V. Ramana, a nuclear energy expert at the University of British Columbia in Canada, told Energy Intelligence. "The necessity or otherwise of many maintenance activities and component replacements and other programs were evaluated on the basis that the plant didn't have to operate beyond 2025."

Those views are echoed by state officials overseeing Diablo Canyon's operations and tentative life extension, and by the Alliance for Nuclear Responsibility over recent unplanned outages related to equipment failures in the Unit 2 main generator.

PG&E, for its part, cites a precedent involving a Utah research reactor. The Aerotest radiography and research reactor initially submitted its LRA in 2005, and the NRC formally denied the application in 2013. Aerotest later "supplied additional information to the NRC which, in 2017, ultimately led the NRC staff to withdraw its earlier denial and 'resume its review of the license renewal application as it existed' before the review was terminated," PG&E said in its request to the NRC. According to Ramana, the safety challenges facing Diablo Canyon are incomparably greater than those of the Aerotest reactor, a 250 kilowatt pool-type reactor. "PG&E, at the very least, should be required to submit a whole new LRA," Ramana said.

If the NRC denies PG&E's request to pick up where the previous LRA left off, PG&E said it would request an exemption allowing the

agency to fast-track a new LRA and extend the existing operating licenses until a final determination on the LRA is made. The utility said it would submit a new LRA by the end of 2023.

## Existing Operational Woes

Backed by California Gov. Gavin Newsom, the newly passed state law supporting Diablo Canyon's life extension for at least five years also exempts the plant from state marine life standards so it can continue operating. Because of the legislative reversal, PG&E has also applied for the US Department of Energy's $6 billion Civil Nuclear Credit program, for which Diablo Canyon is currently the only eligible candidate. The federal agency has yet to make a decision on the application.

The new California law also allows Diablo Canyon to recover up to $300 million in costs from ratepayers for unplanned outages that are not "the result of a failure of the operator to meet the reasonable manager standard." The Alliance for Nuclear Responsibility is challenging just such a rate recovery, citing "the botched installation of the newest equipment at the plant" that led to five unplanned outages covering 150 days in 2020 and 2021.

In its request to the California Public Utilities Commission (CPUC), the Alliance asks that PG&E's request to recover nearly $180 million to cover the outages be denied. "The extraordinary size of these costs is a very bad omen for Diablo's post-2024 future," Executive Director Rochelle Becker said in a statement. "Forcing ratepayers to give PG&E a $300 million annual buffer against its own mistakes will inevitably encourage sloppier operating practices at Diablo Canyon."

The equipment failure involves the Unit 2 main generator stator that was placed in service in December 2019 and has since undergone several operational problems, including high vibrations. Every power plant uses a generator to transfer electricity to the grid. The stator is a component of the generator that creates a voltage using magnetic fields, but high vibrations in the stator can cause deterioration and premature failures in the equipment. According to PG&E, inspections, forensic analysis, modifications and repairs connected to the outages have so far cost some $80 million, and while the utility is blaming vendor Siemens for the problems, the Alliance for Nuclear Responsibility places responsibility with PG&E.

"Even if these blame-the-vendor claims are accurate, PG&E cannot evade responsibility for the performance of its selected contractor," the Alliance states. "PG&E's remedy for such deficiencies must be anchored in the 'contractual and warranty obligations' of its vendors, not a presumptive reimbursement from its ratepayers for any lapse in its own diligence."

*Jessica Sondgeroth, Washington*

# CORRECTIONS

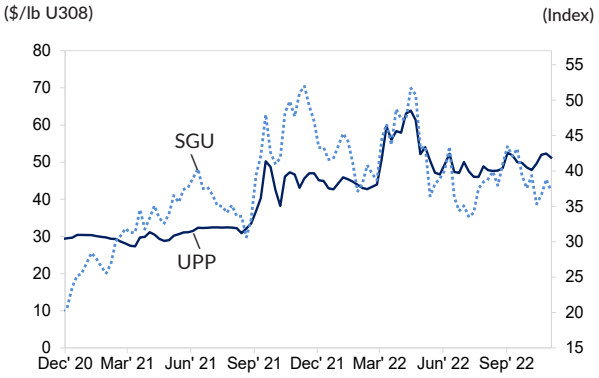
In the Oct. 28 issue of *Nuclear Intelligence Weekly's* Weekly Roundup we described TerraPower's Natrium reactor as molten salt. In fact, the 345-megawatt fast reactor is sodium-cooled coupled with a molten salt-based integrated energy storage system. In our feature on China's fast reactor program we suggested that China's under-construction CFR-600s would initially use low-enriched uranium when in fact the reactors will use Russian-supplied high-enriched uranium for the first seven years before introducing mixed-oxide fuel, as we have reported previously. Also fast reactors produce more plutonium (as opposed to energy) than they consume. We apologize for these mistakes.

# URANIUM MARKET UPDATE

*All prices as of Thursday, November 3, 2022*

## UPP VS. SOLACTIVE GLOBAL URANIUM INDEX

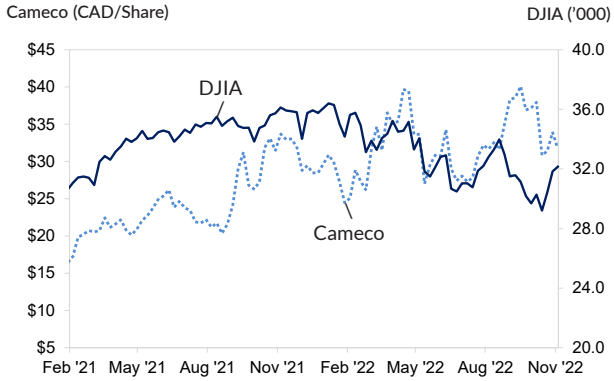
(previous 52 weeks)




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

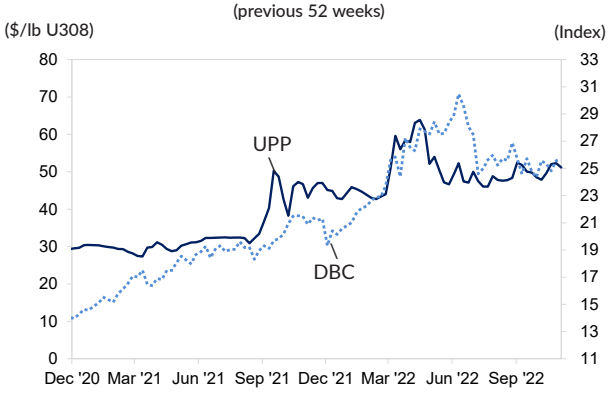
(previous 52 weeks)




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

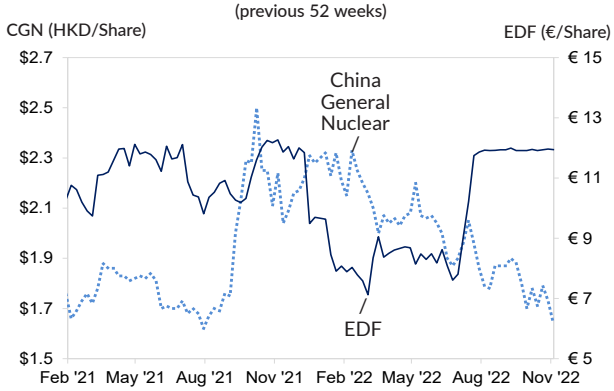
(previous 52 weeks)




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. | Oct '22 | Sep '22 | Aug '22 | Jul '22 | Jun '22 | May '22 | Apr '22 | Mar '22 | Feb '22 | Jan '22 | Dec '21 | Nov '21 |
| **Uranium** ($/lb U3O8) | | | | | | | | | | | | | |
| Low | -1.00 | 47.50 | 48.50 | 47.50 | 45.50 | 45.50 | 46.00 | 52.50 | 51.00 | 42.50 | 43.00 | 42.00 | 43.00 |
| High | +0.25 | 52.75 | 52.50 | 53.50 | 50.50 | 52.50 | 54.00 | 64.00 | 60.00 | 44.50 | 46.50 | 47.00 | 47.50 |
| **Conversion** ($/kgU) | | | | | | | | | | | | | |
| Low | +2.00 | 38.00 | 36.00 | 36.00 | 32.00 | 30.00 | 30.00 | 28.00 | 26.00 | 16.00 | 16.00 | 16.00 | 15.00 |
| High | +3.00 | 42.00 | 39.00 | 39.00 | 37.00 | 33.00 | 33.00 | 30.00 | 28.00 | 17.00 | 17.00 | 17.00 | 18.00 |
| **Enrichment** ($/SWU) | | | | | | | | | | | | | |
| Low | +1.00 | 93.00 | 92.00 | 90.00 | 89.50 | 84.00 | 84.00 | 82.00 | 100.00 | 59.00 | 57.00 | 56.00 | 56.00 |
| High | - | 96.00 | 96.00 | 92.00 | 95.00 | 150.00 | 150.00 | 150.00 | 150.00 | 61.00 | 59.00 | 57.00 | 57.00 |

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.