

NUCLEAR INTELLIGENCE WEEKLY[®]

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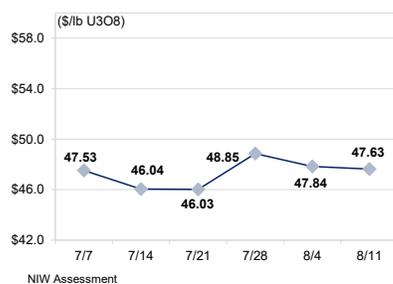
Market Points

Two North American mining juniors, Texas-based Uranium Energy Corp. and Toronto-based Denison Mines, are locked in a bidding war to acquire Vancouver-based UEX, which last year acquired a Canadian mining junior it now jointly owns with Denison.

Denison, meanwhile, announced that it is fully permitted for the in situ recovery feasibility field test planned at its 90%-owned Wheeler River project in northern Saskatchewan.

Spot market activity was once again illiquid with Energy Intelligence's Uranium Price Panel delivering an average price of \$47.63/lb. U3O8 for Thursday, Aug. 11, down from \$47.84/lb. on Aug. 4.

UPP: \$47.63/LB U3O8



WEEKLY ROUNDUP

EDF Files Suit for More than \$8 Billion

- EDF is suing the French government for at least €8.34 billion (\$8.6 billion) for forcing it to sell an additional 20 terawatt hours of electricity at a loss-making tariff of €46.20 under the hugely controversial “Arenh” scheme. That’s a fifth of the 100 TWh the utility is normally forced to sell at €42/TWh to competing energy suppliers who can then resell it at market rates. When it announced the plan on Jan. 13, the government said it was doing it to protect consumers in the face of soaring electricity prices. In its announcement Aug. 9, EDF said that following “an in-depth legal analysis, and in light of the losses incurred” as a result of the forced additional sales, “EDF today filed a legal claim with the Conseil d’Etat (the French administrative supreme court), as well as a claim for indemnification, for an amount estimated to date at 8.34 billion euros, with the French State.” This is in line with 2022 losses EDF projected in January of between €7.7 billion–€8.4 billion.
- Brookfield Business Partners (BBU) has generated “about \$800 million in proceeds” from a dividend recapitalization of Westinghouse, which is up for sale but facing headwinds, including “a significant slowdown in financing for private equity transactions,” BBU CEO Cyrus Maddon told a second-quarter investment call Aug. 5. BBU’s share of the proceeds was \$315 million, in line with its equity stake in the US nuclear vendor. In response to questions, Maddon said that any prospective foreign buyer of Westinghouse would face numerous US and foreign regulatory hurdles including a US CFIUS [Committee on Foreign Investment in the United States] review, a government interagency process required for foreign purchases involving “critical” technologies. Maddon said that despite the slowdown in transaction activity, “there’s lots of financing” for investment-grade borrowers. A source familiar with the situation told Energy Intelligence that while Brookfield is “in discussions with a serious business” to sell Westinghouse, “they’re not going to get \$10 billion that they think they’re going to get.” And after the dividend recap, they’ll “discount the sale price by \$800 million.”
- X-Energy and Dow have signed a letter of intent aimed at deploying X-energy’s Xe-100 high-temperature gas reactor at one of the chemical giant’s US Gulf Coast sites. Dow also intends to take a minority equity stake in the nuclear developer, “working with the company to deploy small modular nuclear technology,” according to the Aug. 9 announcement. “The Xe-100 reactor plant would provide cost-competitive, carbon free process heat and power to the Dow facility,” and is “expected to be operational by approximately 2030.” A spokesperson for Dow told Energy Intelligence in an email that “small modular nuclear power is expected to be cost competitive with Dow’s alternatives to meet our 2050 goals for carbon neutrality.” Dow Chairman and Chief Executive Officer Jim Fitterling called advanced small modular nuclear technology “critical” to Dow achieving zero-carbon emissions by 2050 and “a great opportunity for Dow to lead our industry in carbon neutral manufacturing by deploying next-generation nuclear energy.”

NUCLEAR FUEL MARKET

North American Juniors Vie for Canadian Assets

The uranium mining sector is awaiting the potential consolidation of North American assets early next week, with two juniors competing for the acquisition of a third. Over the past month, US-based Uranium Energy Corp. (UEC) and Toronto-based Denison Mines have been locked in a bidding war to acquire Vancouver-based UEX.

UEX is a Canadian uranium and cobalt exploration and development company with uranium assets in the Athabasca Basin and a 50% ownership stake in JCU, in which Denison owns the other 50% stake. JCU holds stakes in several Canadian greenfield projects, including minority shares in two projects, one of which is majority-owned by Cameco and the other by France's Orano.

The bidding saga began on Jun. 13, when UEC entered into an "arrangement agreement" with UEX. The agreement was amended on Jul. 23 after Denison counteroffered. Another round followed when UEC increased its offer on Aug. 5 and Denison counteroffered on Aug. 8, with both offering to acquire all outstanding UEX common shares.

However, Denison threw in a sweetener for UEX shareholders of "0.32 shares of Denison in exchange for each share of UEX held." That represents "a 7% premium to the price implied" by the previous offer from UEC, according to Denison.

UEX upped the ante for UEC in an Aug. 9 statement arguing that the offer represents a "9% premium to the 20-day volume weighted average price to August 8, 2022 implied by the UEC Arrangement Agreement."

UEX's board, in response to the Aug. 8 Denison proposal, postponed a shareholder meeting from Tuesday, Aug. 9, to Monday, Aug. 15, to determine whether Denison's offer is in fact superior to UEC's offer. Because the negotiations are under the framework of UEC's initial arrangement agreement with UEX, the UEX board can only vote in favor of the UEC offer or simply determine that the Denison deal is superior, which would essentially allow the bidding war to continue.

UEC, per terms of the arrangement agreement, has five business days from Aug. 8 to match or exceed the offer, but disputes that

Denison's offer is superior. UEC President and CEO Amir Adnani said in an Aug. 9 statement that the Denison offer "introduces deal uncertainties for UEX shareholders," and as such UEC is "extremely disappointed in the actions of the UEX board in delaying the shareholder vote." Adnani notes that of the more than 38% of outstanding shareholders that have already voted on the UEC proposal, 93.4% voted in its favor. Energy Intelligence understands that shareholders can still change their vote.

The probable consolidation builds on prior acquisitions. UEX in August last year acquired Canadian exploration company JCU from Overseas Uranium Resources Development Co. for C\$41 million (US\$32 million). At the time, UEX agreed to sell 50% of JCU shares to Denison for C\$20.5 million, after Denison provided UEX with an interest-free three-month term loan of C\$40.95 million to help finance the acquisition.

JCU's portfolio includes a 30.1% interest in Cameco's Millennium project, a 10% interest in Denison's Wheeler River project, and a 33.8% interest in Orano Canada's Kiggavik Project, located in the northern Canadian territory of Nunavut, as well as minority interests in nine other greenfield uranium projects in the Athabasca Basin.

Adding to the timeliness of the offers, Denison on Aug. 8 also announced that its in-situ recovery feasibility field test planned for the Wheeler River project is now fully permitted. And UEC announced on Aug. 2 that it had submitted an offer to supply the new US national uranium reserve run by the Department of Energy's National Nuclear Security Administration (NNSA), which is authorized to purchase up to \$75 million worth of domestic uranium and conversion services. Energy Intelligence understands the NNSA is looking to procure about 1 million lbs. of already mined U3O8, which would at today's price cost about \$48 million.

Spot market activity this week, meanwhile, hardly flinched on weakened midsummer liquidity. Energy Intelligence's Uranium Price Panel delivered an average price of \$47.63 per pound U3O8 for Thursday, Aug. 11, down from the previous week's price of \$47.84/lb.

Jessica Sondgeroth, Washington

URANIUM PRICE PANEL

For the week ended August 11, 2022

	Weekly Spot Market Prices													
	Chg.	Aug		Jul				June				May		
		11	4	28	21	14	7	30	23	16	9	3	26	19
Price (\$/lb U3O8)	-0.21	47.63	47.84	48.85	46.03	46.04	47.53	50.00	47.13	47.39	52.25	49.40	46.67	47.14
Total Assessments	1.00	9.00	8.00	9.00	10.00	9.00	10.00	10.00	10.00	11.00	10.00	10.00	12.00	10.00
% within 1 StDev	2.78	77.78	75.00	55.56	80.00	55.56	70.00	60.00	90.00	72.73	70.00	40.00	75.00	80.00
Low (\$/lb U3O8)	-0.25	47.25	47.50	48.50	45.75	45.50	47.00	49.25	47.00	46.60	51.70	49.00	46.00	47.00
High (\$/lb U3O8)	-0.25	48.00	48.25	49.25	46.25	46.75	48.50	50.75	47.50	48.50	52.50	50.15	47.50	47.50
Variability*	0.04	0.04	0.00	0.00	0.00	0.31	0.50	0.16	0.06	0.09	0.40	0.32	0.05	0.00

*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

Support Grows for IAEA Visit to Zaporozhye

Support for an International Atomic Energy Agency (IAEA) visit to Ukraine's embattled and Russian-occupied Zaporozhye nuclear power plant (ZNPP) grew this week, with positive signals from both Ukraine and Russia, alongside unanimous approvals from the UN Security Council. But the devil is in the details, and it's not clear that a breakthrough is in sight over the logistics of such a visit, and in particular how IAEA officials might traverse the five miles from Ukrainian-held territory to Zaporozhye. UN Secretary-General Antonio Guterres and Washington this week endorsed the idea of creating a demilitarized zone around the plant, but Moscow is not playing ball.

"Over the past several days there have been reports of further deeply worrying incidents that could, if they continue, lead to disaster," Guterres said in a statement Thursday, Aug. 11, prior to a special UN Security Council session on the matter. "I am calling for all military activities in the immediate vicinity of the plant to cease immediately and not to target its facilities or surroundings."

Russia called for the special session in an apparent bid to convince fellow members of its side in the debate over who bears responsibility for fighting at the plant, including the attacks which began last Friday, Aug. 5, and continued this week. Ukraine's UN envoy, Sergiy Kyslytsya, told the Council that Russia "decided to go for broke" in calling for the meeting only after realizing it hadn't succeeded in convincing the public it bore no responsibility for the shelling. "This call looks especially cynical considering their most recent attack on the facility, which happened earlier today and directly endangered both the plant facilities and personnel."

IAEA Director General Rafael Grossi spoke to the session via a video link and used the occasion to make a major push for an agency visit to the six-unit nuclear plant. The situation at Zaporozhye is "deteriorating rapidly," he told the session, adding that the agency has been receiving information from both sides "indicating the state of the facility, its operation and the damage assessment. However, the contents of such statements are frequently contradictory, and without — I repeat without — a physical presence, the IAEA cannot corroborate some very important facts."

Vassily Nebenzia, Russia's ambassador to the UN, told fellow Council members that it's "common sense" that the incoming missiles hitting Zaporozhye facilities are coming from Ukrainian rather than Russian forces. "Elementary logic would suggest that our soldiers would have no reason to shell" the plant that they already occupy.

Ukrainian Ambassador Kyslytsya told the meeting that shelling on Aug. 6 "damaged three radiation monitoring detectors at the dry spent fuel storage facility site," making impossible early detection "in the event of deterioration of the radiological situation or

release of radiation from the spent fuel containers." He also blamed Russian armed forces for several explosions the previous day that damaged a 750 kilovolt external power supply line, ultimately lead to one reactor being powered down, and left the plant dependent on one remaining power line. "Should this last line be damaged," said Kyslytsya, the Zaporozhye nuclear plant "will be totally deenergized." He said that Russian plans "aim at disconnecting" the plant from "the energy system of Ukraine and cutting off electricity in the south of the country."

In prepared speeches, Council members all endorsed the idea of an IAEA mission to Zaporozhye but left the agency to work out how it would actually take place. There were multiple calls for an end to fighting at the plant with Guterres and US Under Secretary of State for Arms Control and International Security Bonnie Jenkins specifically endorsing Ukraine's proposal for a demilitarized zone around the plant.

A ZNPP Demilitarized Zone?

"I urge the withdrawal of any military personnel and equipment from the plant and the avoidance of any further deployment of forces or equipment to the site," Guterres said in his statement. "The facility must not be used as part of any military operation. Instead, urgent agreement is needed at a technical level on a safe perimeter of demilitarization to ensure the safety of the area."

This proposal was seconded by Washington, which pushed for a number of smaller steps "in the absence" of a full Russian withdrawal from Ukraine. These include an IAEA mission to Zaporozhye "in a manner that respects Ukrainian sovereignty," the return of full control of Zaporozhye to Ukraine, and allowing Ukrainian staff at the plant "to fulfill their important duties free from the pressure of Russia's armed forces," Jenkins explained in her speech to the Council. "The United States also supports Ukraine's proposal to create a demilitarized zone around this Zaporozhye plant."

Russia's Nebenzia shot down the idea during a press scrum immediately after the session, suggesting it would leave the plant vulnerable to terrorists. "To demilitarize the station would make it prone to whoever [is] wanting to visit it," Nebenzia told reporters, and "with what purposes, and what aims" visitors might come "nobody knows. We cannot exclude any provocations, terrorist attacks on the station. We have to preserve the station."

A Stabilizing Mission?

That left the IAEA mission as the only proposal on the table that might, as Grossi put it, "provide a stabilizing influence."

Grossi also gave his fullest explanation yet of what such a mission might entail. "We will assess the physical damage to the facility," determine "whether the main and backup safety and security systems are functional, and evaluate the working conditions of the control room staff," said Grossi.

The IAEA mission “will also allow us to perform urgent safeguards activity verifying the status of the reactors, and inventories of nuclear material including fresh and spent fuel storage where we currently have no remote data transfer of surveillance,” Grossi explained. “Furthermore, we need to perform maintenance on all IAEA safeguards equipment in order to ensure that remote data transmission and the maintenance of continuity of knowledge, which is indispensable after leaving the facility.”

But all of this is dependent on getting IAEA experts to the plant, and Grossi pointed out that as the facility is “currently in Russian-occupied territory” it “cannot be reached by traveling exclusively through Ukrainian-controlled territory. We need to work pragmatically with authorities of both countries in efforts to obtain access for our experts to Zaporozhye.”

To a certain extent this should be no problem given that both sides support the idea of a visit. With that said, Energoatom officials earlier pushed back stridently against a visit fearing it might legitimize the Russian occupation, and there was little public evidence of support from Kyiv. However, on Aug. 9 Ukrainian Foreign Minister Dmytro Kuleba wrote a letter to both Grossi and Guterres requesting an IAEA visit and on Thursday Kyslytsya underscored that support, insisting that the government has wanted an IAEA visit to the plant since it was invaded. “Since the beginning of Russia’s occupation of ZNPP, Ukraine has insisted on the need to send a mission,” he told the Council, and “we deeply regret ... that such a visit has not yet taken place due to the destructive Russian position.”

Now the difficulties appear to be entirely logistic, at least publicly. “Everybody believes that this mission must take place,” Grossi told the Security Council after all the members had spoken. “It’s no longer a matter of ‘If’, it’s only a matter of ‘When’, and the ‘When’ must be as soon as possible. It’s only the ‘How’ that needs to be addressed.” Grossi concluded that he will be “intensifying” his coordination with Ukraine, with Russia, and with the UN.

Phil Chaffee, New York, Stephanie Cooke, Washington

UNITED STATES

Merchant Reactors Await \$30 Billion in Tax Credits

The US Congress is poised this week to finally pass a climate bill that includes \$30 billion in nuclear production tax credits (PTCs) to prevent struggling reactors from retiring and support the Biden administration’s plan to decarbonize the domestic electricity sector by 2035. But how much nuclear utilities will benefit from the measure will depend on their revenues, largely reflective of electricity prices, and their costs. And with electricity prices rising, the tax credits could incentivize reactor operators to expend more capital to extend reactor operating licenses.

The Inflation Reduction Act of 2022 includes a total of about \$258 billion in energy-related tax credits from fiscal 2022 to 2031, with about \$326 billion in tax increases on companies that take advantage of the current tax system, including loopholes, and another \$68 billion in spending over the same 10-year period, according to a preliminary analysis by the Joint Committee on Taxation based on the Senate-passed version of the bill. Building off more than a year of negotiations, and the failed Build Back Better Act, the legislation represents a surprising achievement by Democratic Sens. Chuck Schumer of New York and Joe Manchin of West Virginia in overcoming an impasse and shaping the next 10 years of US tax policy around President Joe Biden’s climate agenda.

“The tax framework of the energy tax provisions is structured as a hybrid approach” that “would initially extend existing tax credits (and create certain new credits) before transitioning to a technology-neutral approach that is intended to allow power producers to qualify for either a production tax credit or an investment tax credit for any facility with zero or net-negative carbon emissions,” according to an Aug. 3 Pillsbury Law firm analysis. The IRA would also extend an investment tax credit to advanced reactors that enter service after 2024 and provide \$700 million toward the procurement of high-assay low-enriched uranium for advanced reactors.

“Passage of the IRA would be a win-win-win,” Constellation Energy (formerly Exelon) President and CEO Joe Dominguez told investors in an Aug. 4 earnings call. “It preserves and extends baseload clean energy resources that are vital to America’s energy mix and our fight against the climate crisis. It preserves thousands and thousands of family-sustaining jobs and creates even more jobs. And it saves consumers’ money in states that have preserved these assets.”

The nuclear production tax credit is intended to primarily benefit struggling facilities, with a base rate of \$3 per megawatt hour for qualified operating reactors, and an increase to \$15/MWh for qualified reactors that meet prevailing wage standards. But there is a limit to how much a reactor can collect if it is performing well financially. For reactors generating more than \$25/MWh in electricity revenue, including revenue from other subsidies, the provision would reduce the PTC by the lesser of \$3/MWh or 80% for every \$1/MWh in revenue that exceeds the \$25/MWh threshold. And the credit zeroes out for reactors with revenue in excess of \$43.75/MWh. This is aimed at ensuring that struggling reactors are prioritized in the \$30 billion tax credit program, but it could also be an incentive for reactor operators to increase their costs with major capital investments in plant upgrades and life extensions.

“The provisions in the IRA,” Dominguez added, “not only support the continued operation of our assets but create policy support, which, if extended, supports the 80-year license life that our assets could operate to, giving Constellation and its owners long-term clarity.”

The credits take effect in 2024 and expire at the end of 2032. A prior iteration of the provision would have begun the program in 2022 with expiration in 2027.

Degrees of Qualification

About 40 merchant reactors, or nearly half the US nuclear fleet, would be theoretically eligible for the PTCs; however, much will depend on the US Treasury Department's determination of how to administer the program, and its accounting standards for reactor

revenues. And given that the credits will not be available until 2024, the level at which reactors will qualify for the tax credit depends on electricity market prices, which have been rising for the last couple of years.

For example, in the largest competitive market, operated by PJM

FINANCE

Tax Credits for Nuclear Hydrogen Production

The Inflation Reduction Act of 2022, in addition to providing tax credits for operating merchant reactors in the US, would also incentivize hydrogen production generated from nuclear power. Alongside a \$9.5 billion US Department of Energy (DOE) program to develop four hydrogen hubs across the country, the federal support could be a catalyst for bringing nuclear-powered hydrogen production to market.

A handful of US nuclear operators are in the analysis stage of incorporating hydrogen production into their reactor operations. Arizona Public Service (APS), for example, is working with PNW Hydrogen, an affiliate of Pinnacle West, to assess "the technical feasibility of high-temperature electrolysis using electric power and thermal energy from one of the nuclear units at the Palo Verde Generating Station," APS Director of Sustainability Eric Massey told Energy Intelligence. "The assessment will determine if siting a demonstration-scale system at the plant can be accomplished within the design and licensing bases" and "consider the capital and operating costs" with respect to "regional power prices."

Depending on the outcome of that cost assessment, the Inflation Reduction Act's hydrogen production tax credit (PTC) could provide a strong incentive to move forward on the project. So long as a nuclear facility meets prevailing wage standards, it stands to receive a tax credit of \$3 per kilogram of hydrogen production. The hydrogen PTC takes effect in 2023 and expires at the end of 2032. Currently, the cost to produce hydrogen through electrolysis using renewable power varies from \$10-\$17/kg, whereas hydrogen produced with natural gas costs up to \$2/kg in the US, and about \$5-\$6/kg in other parts of the world where gas prices are higher. A nuclear operator collecting the hydrogen PTC could, theoretically, also collect a \$15 per megawatt hour PTC for nuclear generation if it meets certain revenue requirements.

DOE Hydrogen Hubs

But the advancement of nuclear-powered hydrogen production depends in large part on a \$9.5 billion DOE program to develop four hydrogen production hubs around the country, at least one of which would produce hydrogen from nuclear power. The program was enacted in November last year as part of the \$1.2 trillion Infrastructure Investment and Jobs Act. The act appropriat-

ed \$8 billion for fiscal 2022-2026 to the newly created Office of Clean Energy Demonstrations to develop the four regional hubs. The DOE in June issued a notice of intent to launch the program and is expected to open it up to applications in mid-September.

The act also appropriated \$1 billion to fund a clean hydrogen electrolysis program that aims to reduce the cost of producing clean hydrogen to less than \$2/kg by 2026. And the remaining \$500 million would go toward research and development to enhance clean hydrogen production, processing, delivery, and storage.

Today about 98% of hydrogen production is derived from fossil fuels. But if the carbon footprint can be reduced, hydrogen could be used to store energy and to power fuel cells to "decarbonize hard-to-abate energy sectors, such as transportation, power, industry, and buildings," according to a July report from the Nuclear Hydrogen Initiative (NHI). The NHI is a relatively new coalition of nuclear operators, advanced reactor vendors, nuclear supply chain companies, industry organizations and government laboratories, among others, promoting nuclear hydrogen as a climate solution to decarbonize the global energy system.

"Even though there are companies that will pay a premium for clean hydrogen, right now it's not really at scale," Pillsbury attorney and NHI consultant Elina Teplinsky told Energy Intelligence. "Because there's not yet a big hydrogen market, if somebody really wants to do this at scale versus a pilot, it's really hard for them to justify basically losing money."

But for nuclear power plants like Palo Verde, hydrogen production could complement reactor operations, particularly as peak renewable generation periods diminish demand for nuclear energy. "Palo Verde operates best when the units are operated at full power and without being required to dispatch (vary) power to meet grid and customer demand, especially in response to the dynamic changes we experience with variable renewable generation," Massey said. "Using Palo Verde's energy to generate hydrogen during these parts of the day allows hydrogen to act like a battery. Palo Verde would be able to maintain a stable output during the hours where renewable energy is readily available while creating carbon-free hydrogen for later use."

Jessica Sondgeroth, Washington

Interconnection, lower power prices in 2020 meant that “no nuclear plants covered their fuel costs, operating costs and incremental capital expenditures,” according to the PJM 2022 State of a Market report released in May. In 2021, however, “all nuclear plants covered their fuel costs, operating costs and incremental capital expenditures as a result of higher energy prices.” The 2021 surplus for the PJM reactors ranged from \$3.9–\$19.7/MWh, according to the report.

This year all 18 of PJM’s nuclear plants should realize a surplus ranging from \$23.89–\$42.63/MWh, based on “forward prices for energy and known forward prices for capacity,” the report said. It’s as yet unclear how much spot market electricity prices versus forward prices in the capacity auction markets, which guarantee PJM baseload electricity if it’s needed, will factor into annual revenue requirements for the PTC.

The market report uses Nuclear Energy Institute estimates of operator costs that in the PJM range from \$27–\$40/MWh. Those recent cost estimates represent a decline over the past decade, as reactor operators have taken cost-saving measures such as reducing the length of refueling outages. If reactor operators decide to extend the life of their units, incentivized by the PTCs, those costs could begin to increase. This is certainly the case for subsequent license renewals before the Nuclear Regulatory Commission, which in February expanded environmental standards for operators applying to extend reactor operating lives for a second 20-year period to 80 years.

State Subsidies

The House and Senate proposals were initially at odds over whether to include offsets to reduce the value of the PTC if the reactor receives state subsidies. But in the IRA, the \$25/MWh revenue threshold — beyond which the PTC is reduced — is intended to account for other taxpayer contributions either at the federal or state level. That means reactor applicants have to include in their revenue estimates any contributions from state programs or from the \$6 billion US Department of Energy (DOE) Civil Nuclear Credit Program for economically challenged reactors.

While the DOE program has yet to award any credits, three state-created zero-emission programs — in New York, Illinois and New Jersey — currently provide credits ranging from \$9/MWh to \$29.15/MWh. Connecticut also has a zero-emissions program, but it is a power purchase agreement to buy half of the generation from Dominion Energy’s Millstone nuclear power plant.

At the state level, some lawmakers have already included provisions to reduce their state’s obligations if federal subsidies become available. That was the case in New Jersey and more recently with the nuclear bailout in Illinois to salvage three more plants from early closure. Reactor operators may also stop taking state subsidies in favor of a bigger federal tax credit, which Constellation and Duke Energy hinted at in their earnings reports last week.

Jessica Sondgeroth, Washington

FRANCE

Heat Wave Prompts Extended Higher Discharge Limits

The French government this week extended an exemption to thermal discharge rules at certain EDF nuclear plants as a severe drought continued to batter much of France and Europe. This summer’s brutal heat wave has arrived in the midst of a growing European energy crisis, and with power prices soaring to unprecedented levels, French regulators have been forced to back away from rules preventing the discharge of cooling water heated beyond a certain level. The move has prompted backlash from environmental organizations worried about its impact on wildlife populations, but public attention is for the most part focused on the forest fires and dried-up rivers that have resulted from the heat wave, and the human impact.

“Faced with the exceptional meteorological situation, and in response to the need to ensure the safety of the electrical network and to save the natural gas and water reserves of the hydroelectric dams,” France’s Nuclear Safety Authority (ASN) “is temporarily modifying its prescriptions governing thermal discharges” from five EDF plants, the regulator announced on Aug. 8: Blayais, Bugey, Golfech, St. Alban and Tricastin. The measure adopted by the ASN on Aug. 4 and approved by the government Aug. 5 extends an exemption first granted Jul. 15 at three reactors through to Sep. 11.

Exemptions developed after the intense heat waves of 2003 and 2006 allowed for higher thresholds in the event transmission systems operator RTE “expresses the need to maintain a minimum power to ensure the security of the electricity network.” RTE has done this repeatedly this summer, allowing EDF reactors to operate at full power unless or until their thermal output approaches the higher limit. In “normal climatic conditions,” a lower threshold applies, and if it looks as if a reactor could exceed the threshold power output can be lowered as far as zero to reduce the effect of thermal discharges.

Europe’s Power Crisis

ASN’s justification for its move — the unholy combination of the heat wave, preservation of the “safety of the electrical network,” and conservation of both gas and hydro resources for the winter — are all factors contributing to a near-term power crisis across Europe, where electricity prices in some markets have soared to more than 10 times their level a year ago. Governments worry about an even starker situation this winter, and this has prompted conservation of both gas supplies and hydro resources. On Aug. 8, Norway, one of Europe’s biggest electricity exporters, announced it was cutting back these exports in order to cut hydro production and refill its dams in preparation for the winter.

Nowhere is the power situation more acute than France, which is in the midst of an unprecedented wave of nuclear outages. EDF

currently has 30 of its 56 domestic reactors shut down for “maintenance, refueling and stress corrosion analysis,” an EDF spokesperson said in an Aug. 11 statement to Energy Intelligence. That has led to some of the most expensive kilowatts in Europe; on the morning of Aug. 11 the one-year forward baseload French electricity price hit €602 (\$618) per megawatt hour, only a year after breaching €100/MWh for the first time in over a decade.

In that type of market, every marginal kilowatt can make a difference, and temperature-related outages hit the supply-demand balance just as hard as geopolitical or safety-related outages. EDF said that its own hydropower output in the first half of this year was down 5.7 terrawatt hours over first-half 2021, to 18.9 TWh, “due to historically low hydropower conditions.”

Limited Impact?

EDF doesn’t provide a comparable figure for how much less nuclear has generated due to the water temperature issue, but points out that this is a recurrent summer phenomenon, and that since 2000 nuclear output losses due to high river temperature and low river flow averaged only 0.3% of the French nuclear fleet’s annual production. Such losses would likely be much higher this year had the ASN not temporarily exempted EDF from the lower thermal discharge thresholds. That’s because of the extraordinary character of the current heat wave, which came earlier than usual — starting on Jun. 15 — and which has been unusually harsh. July 2022 was “the driest July on record,” France’s national meteorological service Météo France said on Aug. 2, and every day since Jul. 17 “France has set a new record for soil drought.”

Things are only getting worse, and it’s conceivable that EDF may be forced to cut its output at certain reactors even with the ASN exemption. “By the middle of August, this situation is likely to get even worse, and the absolute drought record for surface soils, which dates from 2003, will be beaten,” said Météo France.

Were ASN to raise the thresholds once again the already furious pushback would likely grow.

“We warn of the consequences of these decisions on the health of waterways and the risk of an ‘exceptional’ situation which will become the new norm, even if it means suffocating aquatic environments,” Sortir du Nucleaire said in a Jul. 26 statement after the initial ASN efforts to raise the thermal discharge thresholds.

“The continuation of these discharges of hot water in a heat wave not only creates difficult conditions for the endemic aquatic fauna and flora; it also favors the proliferation of invasive species, and also of algae and micro-organisms which can be pathogenic,” continued the anti-nuclear group. “And it is not only the health of the fish, insects, batrachians and algae living in these waters that is at stake, but also the survival of all the species that depend on them. While our interdependence with the living appears more and more evident, we strongly denounce this authorized rampage.”

The ASN says that the raised thresholds are accompanied by a “program of enhanced monitoring” and that to date this program “has not revealed any consequences on the environment. ASN has carried out and will continue to carry out inspections to check the correct application of its decisions.”

For its part the EDF spokesperson said that this enhanced environmental program monitors “the temperature of the watercourse and physico-chemical parameters, as well as hydrobiological monitoring to monitor aquatic fauna and flora. To date, the monitoring programs show that there is no impact on the fauna and flora around the sites.”

Phil Chaffee, New York

IRAN

Breakthrough on JCPOA With Uncertain Outcome

An apparent breakthrough in efforts to resurrect the nuclear deal is the latest peak in a 15-month roller coaster, and it may be the last. EU foreign policy chief Josep Borrell, who on Monday announced a new round of hastily convened talks in Vienna, says the space for additional significant compromises has been exhausted.

Several key areas of disagreement remain, although they are understood to be narrow. But the decision-making endgame takes place in a particularly challenging geopolitical context. Tehran’s ties with Russia have visibly strengthened lately, while US-China relations are in the deep freeze over Taiwan, and in Washington, the Iran nuclear deal is a politically polarizing issue as midterm elections loom. All complicate the outcome.

‘Whac-a-Mole’

Painstaking efforts by the EU mediation team have succeeded in closing the gaps, with Borrell saying the latest indirect negotiations between the US and Iran fine-tuned the text and addressed a handful of remaining issues. Iran seems to have eased off on its demand that the US remove the Revolutionary Guard’s designation as a foreign terrorist organization — a key former stumbling block — although Iranian state media last week denied this. There has also reportedly been progress on guarantees that Iran will benefit economically from the lifting of sanctions, another thorny issue.

The so-called safeguards probes by the International Atomic Energy Agency (IAEA) into Iran’s undeclared nuclear activity dating back decades have instead emerged as the main obstacle to reaching an agreement, even if technically unrelated to the nuclear deal, or Joint Comprehensive Plan of Action (JCPOA). Also unclear is how the final text proposes to resolve the question of expiring

“sunset” clauses — nuclear-related sanctions that are due to start coming off from 2023 under the original deal — and the reality that Iran’s nuclear program is far more advanced than it was.

Nothing is assured, and Borrell warned that “behind every technical issue and every paragraph lies a political decision that needs to be taken in the capitals.” A State Department spokesman said the US is ready to quickly conclude a deal based on the EU’s latest proposals. The administration of US President Joe Biden certainly has an interest in helping Europe with the oil price fallout from efforts to isolate Russia, although that doesn’t necessarily translate into a willingness to agree on significant compromises. But the fragile consensus around the nuclear deal in Tehran means it is still unclear what Iran will decide.

Mohammad Marandi, a professor at Tehran University who has worked with Iran’s negotiating team, underlined the safeguards issue. “One thing is certain,” he told Energy Intelligence. “The IAEA board of governors’ accusations against Iran must be closed before the implementation of a deal.”

Western Pressures, Eastern Pivot

Russia’s moves to tighten ties with Tehran in response to intense sanctions pressures from the West have strengthened Iran’s hand in the negotiations. President Vladimir Putin’s comments on his visit to the Iranian capital last month about closer cooperation on energy, industry and transport and the memorandum of understanding between the National Iranian Oil Co. and Gazprom, potentially worth \$40 billion, are proof for some that Iran can cope fine with US sanctions. Moscow is also interested in Iran for its so-called North-South transport corridor megaproject.

Others remain doubtful about the prospects for greater Russia-Iran cooperation absent US sanctions relief, and they are skeptical that Iran’s defiance of the West is a sustainable strategy. “Iran has been hoping that a pivot towards the east would strengthen its political and economic position in the international community for over a decade now,” Esfandiyar Batmanghelidj, founder of economic think tank Bourse & Bazaar, tells Energy Intelligence. “I think the Iranian experience of working with Russia and China has been one characterized by disappointment.” State-owned energy

firms from both countries froze or withdrew from upstream investment in Iran on the return of US sanctions.

Aligned Incentives, Differing Ideologies

Borrell has stepped up his efforts in recent months to get Iran back into compliance with the JCPOA, emphasizing his determination to see Iran reap the economic benefits of doing so. With Russian crude subject to an EU import ban (and Russian shipments to an insurance and financial services ban) from December, Europe would no doubt relish the chance to resume purchases of unsanctioned Iranian oil, seen as a good alternative to Russian Urals. From Iran’s perspective, the benefits windfall oil revenues would bring to its weakening economy are obvious, notwithstanding the risk that a Republican victory in 2024 US presidential elections means those revenues could be short-lived. Under a revived deal, Iran would also regain access to frozen foreign reserves worth around \$100 billion.

“The problem, I think, is that although there is a degree of clarity among Iran’s economic decision-makers, it is probably a smaller aspect of the decision-making for this administration than it was for the previous administration,” says Batmanghelidj. “For this administration, I think what is of greater concern is essentially ... the political appearance of this deal and how it comes about.”

Russia’s direct interest in facilitating a revived JCPOA, as another important party in the negotiations, is less clear. Besides displacing Russian barrels, a deal promises to ease the energy price pain in Europe that benefits Russia. But sanctions removal could also allow for deeper Russia-Iran (and China-Iran) investment, with Western firms likely to exercise caution for fear of a US reversal. The deal also offers potentially huge security dividends in the Middle East region, where Iran has already initiated talks with Saudi Arabia.

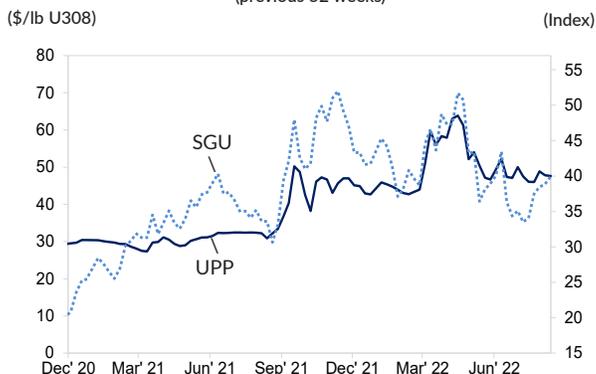
The alternative could see a return to the heightened tensions between Iran and its rivals and tit-for-tat strikes witnessed after 2018. That is hardly in Russia’s interests either, given that it has become ever more involved in the region over the past decade.

Simon Martelli, London, Oliver Klaus, Dubai, Emily Meredith, Washington

URANIUM MARKET UPDATE

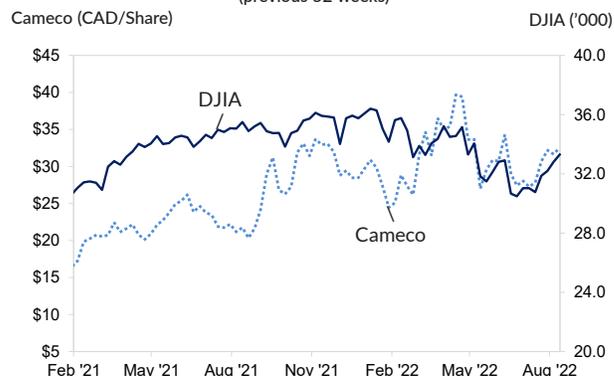
All prices as of Thursday, August 11, 2022

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



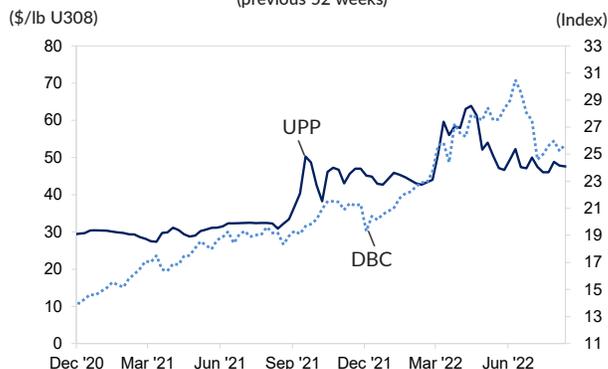
The Solactive Global Uranium Total Return Index, created by Structured Solutions AG, tracks the price movements in shares of companies active in the uranium mining industry. Calculated as a total return index and published in US\$, its composition is ordinarily adjusted twice a year.

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



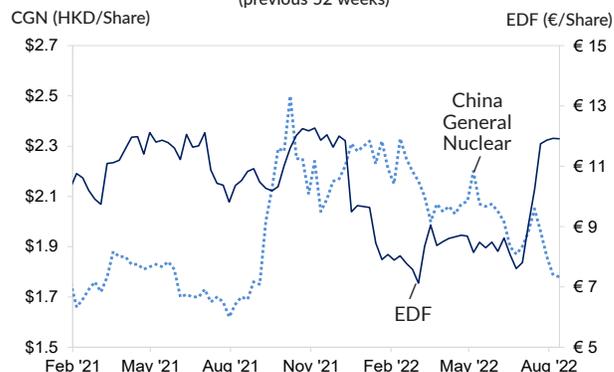
Canadian uranium miner Cameco's stock is valued in Canadian dollars compared with the US dollar on the Dow Jones Industrial Average (DJIA). Roughly two-thirds of DJIA's 30 component companies are manufacturers of industrial and consumer goods. The others represent industries ranging from financial services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

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



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

EDF VS. CHINA GENERAL NUCLEAR
(previous 52 weeks)



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

MONTHLY SPOT MARKET PRICES

	Chg.	2022							2021				
		Jul	Jun	May	Apr	Mar	Feb	Jan	Dec	Nov	Oct	Sep	Aug
Uranium (\$/lb U308)													
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 U308 prices rely on the general consensus of direct market participants and is informed by actual market transactions. This section was previously known as the Nukem Weekly Report and the Nukem Price Bulletin. The methodology for NIW's weekly UPP price is different – more information about the methodology behind that price is available on page two.

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