

NUCLEAR INTELLIGENCE WEEKLY[®]

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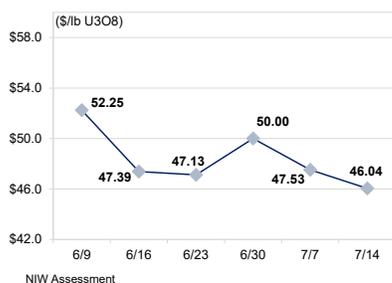
Market Points

Atlantic Project II left St. Petersburg for Baltimore with its cargo of yellowcake and EUP on board, after Ottawa granted a one-year exemption to anti-Russian sanctions.

Energy Intelligence's Uranium Price Panel delivered an average price of \$46.04 per pound U3O8 for Thursday, Jul. 14, down from last week's \$47.53/lb.

Hong Kong-listed CGN Mining's second quarter sales of 1,368 tU were more than double its first quarter sales of 519 tU.

UPP: \$46.04/LB U3O8



WEEKLY ROUNDUP

Ex-Tepco Directors Ordered to Pay \$9.7 Billion in Fukushima Damages

- The Tokyo District Court this week ordered four ex-directors of the Tokyo Electric Power Co. (Tepco) to pay 13.3 trillion yen (\$9.7 billion) in damages to Tepco in response to a shareholder suit over their liability in the Fukushima crisis that began March 11, 2011. The shareholders had asked for over 22 trillion yen from five ex-executives for losses from the plant's decommissioning and reparations to local residents forced to flee in the wake of the triple meltdown at the Fukushima Daiichi nuclear power plant. Presiding Judge Yoshihide Asakura said the four were derelict for not adopting countermeasures after a Cabinet agency warned in July 2002 of both a possible earthquake of up to 8.2 magnitude and tsunami of up to 15.7 meters near Fukushima.
- The Ukrainian government warned the International Atomic Energy Agency (IAEA) this week that Russia "intensifies repressions and terror" against personnel at the Zaporozhye nuclear plant which Russian troops have occupied since Mar. 4. The country's mission to the Vienna-based agency said in a Jul. 12 note verbale that on Jul. 3, "as a result of numerous beatings and torture by Russian occupiers," plant employee Andriy Goncharuk died in an Enerhodar hospital where he'd been brought already in a coma. Moscow "must withdraw troops and weapons" from the territory of the plant "and stop preventing Ukrainian nuclear workers from fulfilling their obligations in the field of nuclear and radiation safety," the diplomatic note demanded. IAEA Director General Rafael Grossi reiterated his "growing concern" over the situation at Zaporozhye in a Jul. 14 statement, and "the impact of such conditions on the safety and security of the plant." Grossi said this "further underlined the need for the IAEA to get there as soon as possible."
- Ontario Power Generation (OPG) updated its green bond framework this week to allow net proceeds from issues to be applied in two key areas of nuclear investment: the refurbishment of the Canadian operator's four Candu reactors at Darlington, and maintenance of existing nuclear facilities. To date OPG has released four corporate green bonds totaling C\$2.15 billion (US\$1.64 billion), the utility said in a Jul. 12 statement, which specifically cited the recent inclusion of certain nuclear investments in the EU sustainable finance taxonomy as a precedent. The OPG move comes after Bruce Power, Ontario's other nuclear operator, raised C\$500 million in a green bond to help finance the refurbishment of its 8-unit Bruce plant. But OPG said nothing about using bond proceeds to fund the inaugural grid-sized small modular reactor (SMR) it plans to build at Darlington with GE-Hitachi. Nor did it mention financing any other SMR efforts, such as those hinted at in a framework agreement signed this week with US-based X-energy. That commits the two companies to pursue opportunities for deploying X-energy's Xe-100 advanced reactors "in Ontario at industrial sites and identify further potential end users and sites throughout Canada." In the US, X-energy is separately advancing plans for a commercial facility at Oak Ridge, Tennessee, to fabricate its higher-enriched uranium Triso fuel.

NUCLEAR FUEL MARKET

Sighs of Relief as Ottawa Grants Year-Long Exemption

Against a backdrop of continued macroeconomic instability, the uranium spot price continued to sag this week, with Energy Intelligence's Uranium Price Panel delivering an average price of \$46.04 per pound U3O8 for Thursday, Jul. 14, down \$1.49 from the previous week's price of \$47.53/lb.

One contributing factor in this slump — it was only three months ago that the price hit a remarkable \$63.88/lb., nearly 39% higher than today — is the growing confidence that the continued delivery of pre-contracted volumes of Russian nuclear fuel (and perhaps more importantly of Kazakh uranium shipped via St. Petersburg) is able to continue.

This week that was made clear when the Atlantic Project II, a ship indirectly owned by Atlantic Ro-Ro Carriers, departed the port of St. Petersburg late on Jul. 11, apparently loaded with enriched uranium product (EUP) owned by Tenex and Centrus, and with yellowcake owned by Kazatomprom. According to Atlantic Ro-Ro's sailing schedule, the vessel is due to arrive at the port of Baltimore on the US east coast by Aug. 1.

Whether the ship's Class 7 cargo would have to be unloaded before the Atlantic Project II set out from Russian waters was an open question a week ago, when nuclear supplier logistics teams were still awaiting a Canadian government ruling as to whether it would exempt such shipments from newly-implemented anti-Russian sanctions. Atlantic Ro-Ro's sister company CIS Navigation and its parent company CISN Shipping Group are domiciled in Canada.

Energy Intelligence understands that after the head of CISN Shipping sent a query to the Canadian government, the company heard back that it would be granted a one-year exemption to the new Canadian sanctions.

This caused sighs of relief across the nuclear fuel industry, and particularly at the two major US nuclear operators depending on delivery of the Tenex EUP on board the vessel. But Ottawa's

response also suggests there are things to worry about before the summer of 2023: the exemption implies that much of the cargo on board would be impacted by the sanctions, although it's still unclear if that would apply to only the EUP as many believe, or for all the Class 7 cargo. If the latter is the case, application of the sanctions would upset the traditional transport route between Kazakhstan, the world's largest uranium producer, and the US, its largest consumer.

For the moment, of course, that route seems safe, and the uranium market can revert to its traditional pattern of summer doldrums. Those doldrums may be compounded by both the broader macroeconomic situation this year, as well as by the continued rebound in uranium production.

In a Jul. 15 quarterly filing, CGN Mining, the Hong Kong-listed subsidiary of China General Nuclear (CGN) responsible for the firm's foreign uranium portfolio, reported total second quarter output of 606.8 metric tons of contained uranium (tU) from the four Kazakh mines it has a 49% stake in, alongside majority-owner Kazatomprom. That's 1.8% more than both firms' planned second quarter output of 596.2 tU and actual first quarter output of 555.9 tU.

CGN Mining also picked up its commercial activity this spring: its second quarter sales of 1,368 tU were more than double first quarter sales of 519 tU. And the Chinese miner, which owns a trading subsidiary in Cambridge, UK, saw a remarkable jump in its average selling price, up from \$46.48/lb. U3O8 in the first quarter to \$53.36/lb. in the second quarter. CGN Mining also purchased more material in the second quarter, and as of Jun. 30 it held 1,548 tU of unsold material at a weighted average cost of \$37.06/lb.

Elsewhere the supply side continues to pick up. Boss Resources, which decided to return the South Australian Honeymoon uranium mine to operation last month, announced promising new drilling data on Jul. 12. Whereas before Boss had planned to ramp the in-situ recovery operation up to annual output of 2.45 million lbs. U3O8, "new mineralisation target areas" delineated by the new drilling "will form the basis of a study to assess and define production ramp up to produce more than 3Mlb/annum U3O8 equivalent."

Phil Chaffee, London

URANIUM PRICE PANEL

For the week ended July 14, 2022

	Weekly Spot Market Prices													
	Chg.	Jul		June						May			Apr	
		14	7	30	23	16	9	3	26	19	12	5	28	21
Price (\$/lb U3O8)	-1.48	46.04	47.53	50.00	47.13	47.39	52.25	49.40	46.67	47.14	50.41	54.00	52.13	61.28
Total Assessments	-1.00	9.00	10.00	10.00	10.00	11.00	10.00	10.00	12.00	10.00	9.00	11.00	9.00	10.00
% within 1 StDev	-14.44	55.56	70.00	60.00	90.00	72.73	70.00	40.00	75.00	80.00	77.78	72.73	55.56	60.00
Low (\$/lb U3O8)	-1.50	45.50	47.00	49.25	47.00	46.60	51.70	49.00	46.00	47.00	49.00	53.50	51.25	59.00
High (\$/lb U3O8)	-1.75	46.75	48.50	50.75	47.50	48.50	52.50	50.15	47.50	47.50	52.00	55.00	53.00	63.25
Variability*	-0.19	0.31	0.50	0.16	0.06	0.09	0.40	0.32	0.05	0.00	0.28	0.50	0.50	0.75

*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.

UNITED STATES

TVA Issues RFP for Carbon-Free Megawatts

In what could be a trend-setting move, the Tennessee Valley Authority (TVA) this week issued a request for supply of up to 5,000 megawatts of “carbon-free” electricity, with delivery commencing somewhere between 2023 and 2029 for up to 20 years. Proposals are due by Oct. 19 and winners will be announced next spring.

The federally-owned electric utility corporation is under the gun for lagging on its zero-emissions goal, and for adding fossil fuel plants across its territory, which includes Tennessee and parts of six surrounding states. Most particularly, TVA has come under fire for a proposal to replace a massive coal-fired plant in Tennessee with natural gas, a move that is opposed by environmentalists and is at odds with the goals of President Joe Biden’s administration to achieve a carbon pollution-free power sector by 2035 and net zero emissions economy by no later than 2050.

TVA’s own goals — as spelled out in a May 2021 strategy document — are slightly different: a 70% reduction in carbon output from 2005 levels by 2030, 80% by 2035 and then achieving net-zero output by 2050. The utility’s latest gambit — which appears to be the largest such carbon-free request for proposals (RFP) in the US — will assist in these goals, and could be the start of a trend among US utilities looking to reduce their carbon footprint over the next two decades. Beyond that, the government agency is reviewing a host of small modular and advanced reactor technologies for development at its Clinch River site in Tennessee, and recently announced a collaboration with Ontario Power Generation, which has selected GE-Hitachi’s BWRX-300 for development at its Darlington site.

“We haven’t seen this before,” said a former senior US nuclear utility executive. “But every utility— power producer — is going to be looking over the next 20 years to get away from all carbon sources. I think depending on which company it is and what their regulatory relationship is, some will need to do it on their own, some will do it like this. There are all kinds of outcomes here.” He added, “I think that if a company like Constellation Energy has nuclear capacity available and could put together a proposal, if it’s competitive and cheaper than other alternatives, it could work.”

In its Jul. 12 RFP, TVA says it will entertain offers from virtually all comers in the renewables and nuclear sectors, as well as from battery storage operators, so long as their resource is operating by Dec. 1, 2029. The project must be within TVA’s territory or “delivered to TVA’s interface with neighboring transmission systems,” and all cost components of such connectivity must be included in “all-in energy prices.” For solar and solar-plus storage projects, respondents must offer on “delivery periods of both 15 and 20 years,” while other carbon-free providers should have “delivery periods between two and 20 years.”

“We’ve opened up the aperture to not only renewables — solar, wind, battery storage — but we’re also looking at any other source that’s carbon free,” TVA Chief Operating Officer Don Moul told The Associated Press. “That could be existing nuclear. That could be existing hydro. Whatever can be delivered to our service territory at a price, and with the reliability level that meets our needs, is fair game.”

Geared Toward Renewables?

While some see the RFP as heavily skewed toward renewables — it specifies a “minimum generation nameplate capacity at the point of interconnection for each site” of 2 MW, the maximum capacity allowed for each site is 500 MW, roughly half the output of a conventional nuclear plant. “They’re casting a very wide net that says ‘we need non-carbon power sources and we’ve given this number so we’re looking for what options there are out in the marketplace,’” said the former utility executive.

For the nuclear sector that likely boils down to any operating nuclear plant within a deregulated market, so long as the operator is willing to foot the bill for transmission and grid connection costs in order to deliver power to TVA’s service territory. Potential candidates, for example, could be Energy Harbor’s troubled Davis-Besse or Perry nuclear plants in Ohio, which is just north of Kentucky and Tennessee — “there’s probably a connector somewhere in Ohio that connects to TVA,” the industry source speculated. With that said, a decision to bid would have to be weighed against the technical and financial ramifications of transmission and connection to the TVA grid.

“There’s two really big ISOs [independent system operators] north of TVA — Miso and PJM — and what TVA is saying is what they want quoted is for delivery of that electricity to their network. You would still have to pay PJM, say, for transmission to that interface. It’s part of the cost you’d be quoting.”

Operators in regulated markets, such as Georgia Power with its massive and as yet unfinished Vogtle nuclear newbuild plant, could in theory be candidates for supply though that would require approval from the state’s Public Utilities Commission and/or the state legislature.

While Maggie Shober of the influential Southern Alliance for Clean Energy (Sace) praised TVA for taking “an important step in continuing decarbonization,” she said it “comes at a time that TVA is adding a significant amount of long-term fossil fuel power plants” across its territory that may limit its ability to achieve net zero carbon. “TVA would need to add at least 40–50 GW of clean energy resources like solar, wind and storage in order to get to zero carbon emissions across its system,” she added in a Jul. 14 blog. Nuclear and hydro capacity combined make up 87% of TVA’s current 14 GW of net-zero generation capacity.

Shober wrote that while TVA has “achieved a higher emission reduction today, compared to 2005 levels, than many utilities, TVA

is now lagging behind comparable utilities in commitments to take the next critical steps to decarbonize.” She noted in particular that Florida Power and Light recently committed to 90 GW of solar and 50 GW of energy storage to achieve net-zero by 2045.

Stephanie Cooke, Washington

JAPAN

LDP Win Augurs Three ‘Golden’ Years of Stable Policies

Japan’s nuclear industry can be at least cautiously optimistic about its prospects after solid wins by the Liberal Democratic Party (LDP) in Upper House elections Jul. 10. They handed Prime Minister Fukio Kishida what the media are calling “three golden years” for carrying out stable policies, and Kishida is stepping up pro-nuclear rhetoric. This week he called for as many as nine reactors to be operating by this winter, even though only five of 10 restarted pressurized water reactors are actually now on line, as part of a drive to ensure stable power supplies. His Jul. 14 statement followed an appeal to “hurry up and restart nuclear power plants” by Japan Federation of Industry (Keidaren) Chairman Masakazu Tokura.

The strong LDP showing means that utilities and power-related industries can now look forward to a period of at least three years before the next elections, unless Kishida decides to gamble for an even stronger mandate by calling a snap election this fall for the 465-seat House of Representatives, in which the LDP and its coalition partner Komeito are 17 seats short of a two-thirds majority. Former LDP prime minister Shinzo Abe’s shocking assassination Jul. 8 while campaigning in Nara City for a party candidate was not seen as having a major impact on the results, but it did put Kishida squarely in charge of his party’s governing strategy.

Much to the dismay of environmentalists, energy policy and climate issues were noticeable mainly by their absence in the campaign. Nevertheless, the impact of the Ukraine conflict was felt deeply by citizens in rising food and fuel prices and tightening power supplies, which helped to reinforce calls for more nuclear energy. And the increasing risk of LNG supply disruptions from Russia in the wake of the Ukraine crisis has given even more impetus to Kishida’s pro-nuclear stance. Even so, whether that translates into more reactor restarts or, longer-term, newbuilds, replacement nuclear power plants or advanced nuclear technologies remains to be seen.

“The tragedy of former prime minister Abe did not have much impact as the LDP was going to win big because of the Ukraine situation and because the people are tired of the divisions in the opposition and their lack of realism about national security,” one

Japanese political scientist told Energy Intelligence. “Kishida will no longer have a back-seat driver in the form of former prime minister Abe and will need to display his own governing strategy to promote Japan’s national interests,” said Institute for National Policy Research executive director Kuo Yu-yen in a seminar at the Taipei-based think tank Jul. 13.

The ballot was less a landslide for the LDP, whose vote share in proportional voting actually dipped slightly, than a strategic defeat for the deeply divided opposition. Exit polls showed that the top issues for voters were the economy, foreign policy and security, along with employment and social security, followed distantly by the environment and energy and constitutional revision. The election was for the House of Councillors, the 245-seat upper house of Japan’s National Diet whose members serve six-year terms, with half up for election every three years. A total of 125 councilors were elected in two ballots with 75 seats from constituencies and 50 from party lists in proportional representation.

The LDP and its coalition partner Komeito secured a combined 146 seats after the LDP won 63 seats and Komeito 13, leaving them with a firm majority and three shy of the coveted two-thirds majority needed to directly propose constitutional revisions. However, this shortfall will be eased by the support for constitutional revision by the right-wing Japan Innovation Party, which won 12 seats and expanded its delegation to 21, and the center-right Democratic Party for the People, whose delegation shrank by two to 10 seats.

The results also showed the isolation of the anti-nuclear opposition. The left-liberal Constitutional Democratic Party remains the largest opposition caucus with 39 seats, down from 45. Other anti-nuclear parties include the Japan Communist Party, now with 11 seats (down two), the left-populist Reiwa with five (up two) and the Social Democratic Party with one seat.

Distant Waters

During his first post-election news conference Jul. 11, Kishida said the government would continue efforts to stem rising fuel prices and accelerate the return to service of “over 10 thermal power plants” so that consumers “would not have to save electricity too much” during hot summer months. The prime minister also vowed to “expand renewable energy and restart nuclear power plants under conditions of confirmed safety and with the understanding of local communities.”

At a Cabinet press conference Thursday afternoon, Jul. 14, Kishida said “there is concern that supply and demand will again be tight this winter. We must prevent such a situation at all costs.”

“I have told the Minister of Economy, Trade and Industry [Meti’s Koichi Hagiuda] that as many nuclear power reactors as possible, at most nine by this winter, should be put into operation to ensure about 10% of Japan’s total electricity consumption and realize stable levels of supply for peak hours,” the prime minister stated.

Noting that utilities are privately owned, Citizens' Commission on Nuclear Energy chairman Kenichi Oshima warned in a tweet Jul. 14 that "the prime minister does not have such authority." The realities are that at best only seven reactors will be on line by this winter. Meanwhile, pressure on power supply may be easing at least for now. Tokyo Electric Power Co. (Tepco) data shows that peak time reserve ratios in the Tokyo area eased in early and mid-July after a very tight week at the end of June when they dipped as low as 3%.

Amidst these multiple pressure points, the Nuclear Regulation Authority (NRA) may be easing up. On Jul. 13 it announced that Tepco's applications for basic reactor design changes for Kashiwazaki-Kariwa-6 and -7 in Niigata prefecture conform to its safety standards. These design changes are intended to address "specific severe incidents," including terrorism but do not include ongoing questions about safety equipment and plant security. Speaking to reporters, NRA Chairman Toyoshi Fuketa emphasized that these issues were separate.

Hiroe Yamamoto, an analyst with Moody's Japan, told Energy Intelligence that "despite long-held policies to support nuclear power, the government has yet to announce concrete actions to

remove considerable roadblocks to restarting nuclear plants."

Yamamoto said utilities with operating nuclear power plants "are currently benefiting as high fuel costs lower the earnings of other utilities that rely on thermal power, but these credit benefits are offset by the large safety investments required before restarts and the consequent increase in debt financing for companies that are already highly leveraged."

For now, Kishida's prime nuclear-related focus is likely to be on restarting idled reactors as the question of "new builds or replacements" is essentially "distant water that cannot put out the fire at hand," commented one Japan-based industry analyst. He noted, however, that Meti "is preparing the groundwork to raise the issue of newbuilds and replacements in the formulation of the next basic energy policy."

A senior Japanese industry professional remains skeptical that Meti's effort will see results. "The evaluation of those interested in nuclear energy is that we cannot expect much from Kishida as he is cautious and not likely to promote that 'hot potato'."

Dennis Engbarth, Taipei City

JAPAN

Roadblocks to Operating Nine Reactors By Winter

Japanese Prime Minister Fumio Kishida's instruction to Economy, Trade and Industry (Meti) Minister Koichi Hagiuda on Jul. 14 to get "at most nine" reactors operating by winter will be tough to fulfill.

Only five of 10 reactors that have been restarted are currently on line, according to Meti, and only seven are likely to be operating in the fall and winter. The currently operating reactors include Kansai Electric's Ohi-3, Kyushu Electric's Genkai-4 and Sendai-1 and Sendai-2, and Shikoku Electric's Ikata-3, all pressurized water reactors (PWRs).

Kansai's 45-year-old Mihama-3 is expected to return to service in August after completing "specific severe incident counter-measures" along with its Ohi-4 PWR. Kansai announced Jul. 13 that Ohi-4, which has been on scheduled outage since Mar. 22, will be restarted Jul. 15 and should return to service Aug. 12.

However, Kansai announced Jul. 8 that Takahama-4 has been in periodic outage since Jun. 8 and that the utility is carrying out inspections for possible cracks in heat transfer tubes. On Jul. 1, Kansai announced that Takahama-3 remained "indefinitely" offline after beginning its current outage Mar. 1. Takahama-1 and -2, the other two "over 40" reactors deemed restartable,

are not scheduled to resume commercial service until June 2023 and July 2023, respectively, after their required anti-terrorism installations are completed.

Hence, Kansai will have three operating PWRs (Mihama-3 and Ohi-3 and -4) in August.

With regard to Kyushu Electric, Sendai-2 resumed operation Jul. 11 and Genkai-4 restarted Jul. 11 and should resume full service in early August. However, Genkai-3 has been on indefinite "regular inspection" since Jan. 21, 2022 while workers investigate a leaking fuel assembly in the primary cooling pool that was discovered Nov. 30, 2021, according to the utility.

Kyushu therefore has three PWRs (Sendai-1 and -2 and Genkai-4) slated for operation in August. Combined with Kansai's three and Shikoku Electric's Ikata-3, this would make only seven reactors likely to be operational in the fall and winter. There are no prospects that other reactors with preliminary Nuclear Regulation Authority approval could be on line before this winter, including Tokyo Electric's Kashiwazaki-Kariwa-6 and -7; Japan Atomic Power Co.'s Tokai-1, Tohoku Power's Onagawa-2 or Chugoku's Shimane-2.

Dennis Engbarth, Taipei City

CHINA

Nuclear District Heating Gains Traction in 'Clean Heating' Push

The use of nuclear power for district heating is gaining traction in China under Beijing's push for "clean heating" — especially in pollution-prone northern regions. The Hongyanhe plant in the northeastern Liaoning province is poised to become the country's third nuclear plant to cogenerate heat for local residents, joining existing nuclear cogeneration projects in Haiyang in Shandong province and Qinshan in Zhejiang.

China's initial commercial nuclear district heating schemes were approved in the mid-2010s, when some provinces faced overcapacity in the power sector. These days power markets are much tighter, but expanded application of nuclear district heating — which is a tried and tested non-power application in countries such as Russia, Romania, Bulgaria, Switzerland and Hungary — indicates that nuclear planners are preparing for more "multi-purpose" use of nuclear energy. This includes deployment in residential and industrial heating as well as in seawater desalination — all part of what Beijing's latest five-year (2021–25) plan terms a "modern energy system." The plan envisages growing the country's nuclear fleet to 70 gigawatts in 2025, from around 55 GW currently.

As Hongyanhe operators began commercial operations at the Unit 6 ACPR-1000 on Jun. 23, they were also putting in place external heating infrastructure for the plant to start supplying heat this coming winter, according to Hongyanhe's controlling owner China General Nuclear (CGN). CGN and State Power Investment Corp. (SPIC) each owns 45% of Hongyanhe, with the remaining 10% held by Dalian Construction Investment Group. Under a Mar. 9 cooperation agreement between the Hongyanhe joint venture and SPI subsidiary Northeast Electric Power Co., heat will be supplied to a neighboring township of over 242,000 square meters for a population of nearly 20,000.

Improved Nuclear Economics

For nuclear plants, supplying heat provides an additional income stream that would boost overall economics, although the extent of the improvement in profitability is unclear, since there is no publicly available data on the heating tariffs paid to nuclear plants.

Given that power crunches appear to be the order of the day, it's almost inconceivable that just eight years ago China's power market was so oversupplied that many nuclear plants faced low utilization rates and poor profitability. Annual nuclear utilization hours started falling in 2014, hitting bottom in 2016 at 7,060 hours, down from the 2013 level of 7,874 hours, according to data from the China Atomic Energy Authority. Around the middle of the last decade, many Chinese nuclear plants suffered output "curtailments" with no market in which to sell all their kilowatts.

National nuclear curtailment averaged 19% in 2016, which is equivalent to having seven reactors idled for the whole year, China National Nuclear Corp. (CNNC) lamented in a posting. Hongyanhe — which only had four reactors then — appeared to be worst hit, with its 2016 operation rate averaging merely 57%, significantly lower than the national average of around 80%.

Operators were forced to petition Beijing to boost their allowed utilization rates — and thus profitability — and in 2017, the government approved "temporary" support measures for nuclear plants, including a guaranteed minimum number of utilization hours. The guaranteed portion of electricity would receive the "nuclear benchmark" tariff rate of 0.43 yuan (US6.3 ¢) per kilowatt-hour. But any output in excess of the guaranteed amount would still be subject to market pricing in competition with coal and other generation sources.

Competing with Coal

Nuclear plant profitability has also been under pressure since 2013 when China drafted nuclear reactors into its power market reform to promote competitive pricing. Under the "Nuclear Power Pricing Mechanism" issued in 2013 by the National Development and Reform Commission, reactors entering operations after Jan. 1, 2013 would basically have to accept price parity with local coal plants.

The grid tariff rate for Hongyanhe-5 and -6, for example, has been set at 0.3749 Yuan/kWh — which is about 13% lower than the "nuclear benchmark" rate but on par with Liaoning province's coal tariff level.

However, nuclear district heating may offer a silver lining to this situation by offering another low-carbon and cost-effective option for local governments under pressure to decarbonize quickly.

The use of nuclear energy in Haiyang has replaced 12 coal boilers. As a result, Haiyang's 2.5 particulate matter concentration fell by 16% while the number of "good air" days rose by 17%, according to data from the Shandong Nuclear Power Co. (SDNPC) — an SPI subsidiary which oversees the Haiyang project.

Unsurprisingly, this has been well received by local residents, one of whom lauded the disappearance of soot from his laundry with the shutdown of a nearby coal plant, according to a *China Daily* report. In addition, the Haiyang resident said his heating bill last winter was cheaper by about 200 yuan (\$30) with nuclear heating, which lowered the local heating fee from 22 yuan per square meter to 21 yuan/sq m.

Haiyang Plans Third Heating Phase

Following the success of Haiyang's first two heating phases, SDNPC is now planning for a third phase. The third phase targets a scale of 900 MW to supply an area of 30 million sq m covering 1 million residents — versus 700,000 sq m and 5 million sq m in the first two phases, the company said in an April announcement.

Work on the latest phase is to begin this year for completion before next year's winter, the company added. Haiyang's third heating phase would simultaneously allow electricity generation of 9.5 terawatt-hours annually per reactor, said SDNPC.

This suggests a reduction of just 5% in electricity output compared with operating purely as a power generator. Under phase three, thermal efficiency would rise to 55.9%, from 39.94% during the second phase and 36.69% in phase one.

Kim Feng Wong, Singapore

UKRAINE

Debating Lessons Learned — With No Obvious Answers

The European Commission and a key group of EU nuclear regulators are poised to jointly respond within days to a push from environmental groups for a series of regionwide "stress tests" of Europe's nuclear facilities, in light of the situation in Ukraine, where the region's largest nuclear plant has been forced to operate under military attack and then occupation.

The response is likely to be negative, as key EU regulators seem to believe the Ukraine situation is too anomalous to require such tests. With that said, they are not oblivious to the troubling nature of the situation at Ukraine's Zaporozhye nuclear plant, and a growing number of them are considering what might be done to address the legal void that exists when it comes to operating nuclear plants in the midst of active military conflict.

This debate over the "lessons learned" from the unprecedented situation in Ukraine comes as the Russian military occupation of Zaporozhye continues to grow ever more gruesome, with allegations of intensifying "repressions and terror" circulated this week in a note verbale from Ukraine to the International Atomic Energy Agency (IAEA).

"In all times of crisis, there is a double reflection which needs to go on," European Commission Deputy Director-General for Energy Massimo Garribba told European Nuclear Safety Regulators Group (Ensreg) officials during its meeting in Brussels late last month. "The first one is, how do you address the emergency?"

Garribba pointed to assistance or offers of assistance by EU national nuclear regulators to their beleaguered Ukrainian counterpart, but also of the way in which they coordinated a joint assessment of the situation in their communications with the public. "The second one is which lessons do we draw from the crisis," said Garribba, noting that civil society has raised "concerns about the situation in the Ukraine and how to address war-time conditions."

A Stress Test Proposal

Nuclear Transparency Watch and the European Environmental Bureau had addressed a letter to Garribba and Ensreg Chair Marta Ziakova on May 19 calling for "post-Ukraine nuclear stress tests, in which safety-relevant aspects of malevolent attacks (sabotage, terrorist attack or acts of war) are assessed, and measures are being worked out to reduce the risks from such events."

The groups argued that in the military attacks on both Chernobyl and Zaporozhye "many aspects around the acts of war committed there are of a general nuclear safety related nature." These include "the quality of the containment structures vis-à-vis potentially used weaponry," as well as the vulnerabilities of radioactive waste storage facilities and cooling and power systems "under military or terrorist attack," the "disappearance of regular supply provisions" and the "necessary structures to maintain a high level of well-being for staff under all circumstances."

While these concerns may be shared, it's unlikely that either Ensreg or the commission is prepared to launch anything comparable to the post-Fukushima nuclear stress tests.

"We recognize that this is a quite unexpected and very exceptional situation, so I'm not sure we will solve this kind of situation by issuing guides," Olivier Gupta, director-general of France's Nuclear Safety Authority, said at the Jun. 20 Ensreg conference when asked whether better nuclear security reference levels should be developed. "I hope it will not become usual that large nuclear countries are places in such a war situation, so I'm not sure this would be the right answer."

Other Legal Instruments?

Stress tests aren't the only possible response, of course, and others at the Ensreg conference contemplated what type of new international legal instruments might be required.

After the Russian troops invaded both Ukraine and the Chernobyl nuclear plant on Feb. 24, "we were a little bit at a loss," explained Garribba, and "we went back to look into the instruments."

The Geneva Convention protocol "is the only binding instrument that exists" for the protection of civilian nuclear facilities, Garribba said, and it's "not enforceable." Beyond that, there are "IAEA general conference resolutions, and board of governors resolutions," both of which are nonbinding. "In any case, Russia" has essentially "disregarded" these resolutions "as they did with other provisions of the UN charter."

Garribba then flagged an Apr. 26 statement from his boss, European Commissioner for Energy Kadri Simson, issued jointly with Commission Vice President and foreign policy head Josep Borrell: "We call on the international community and all relevant actors to immediately start a reflection on how to improve existing international instruments to protect nuclear sites in the

context of war, and on whether new specific instruments might be necessary.”

The rough outlines of the principles to be codified may be in the “seven pillars” of nuclear safety during military conflicts proposed by IAEA Director General Rafael Grossi. “We are working on this with our member states” to issue additional guidance on these pillars, Lydie Evrard, the IAEA’s deputy director general for nuclear safety and security, told the Ensreg conference. “It’s still at the early stage,” but member states have “clearly expressed” a desire for guidance on “how to apply these seven pillars.”

But codification of any such guidance — and particularly binding codification that might spell out legal obligations for military

forces occupying nuclear installations — may be structurally difficult. “Russia is still a designated member of the IAEA Board of Governors,” pointed out Garribba, who went on to remind Ensreg regulators (there appeared to be no Russians in the meeting) that “this membership does not only entail rights and privileges, but also entails obligations and responsibilities. Like the respect for international law and the IAEA statute.”

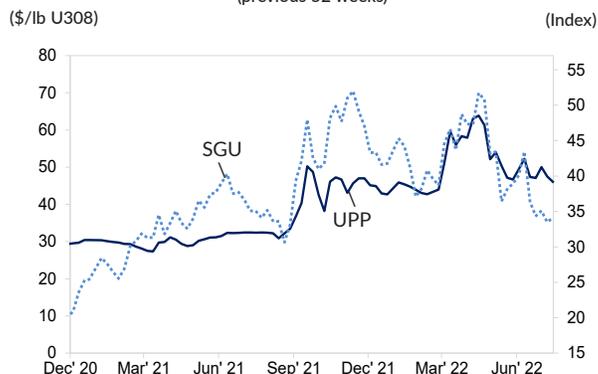
Even changing that statute, of course, would be difficult in the face of Russian opposition, but it’s possible that this year’s IAEA General Conference in September may see at least some member states push to somehow codify Grossi’s seven pillars.

Phil Chaffee, London

URANIUM MARKET UPDATE

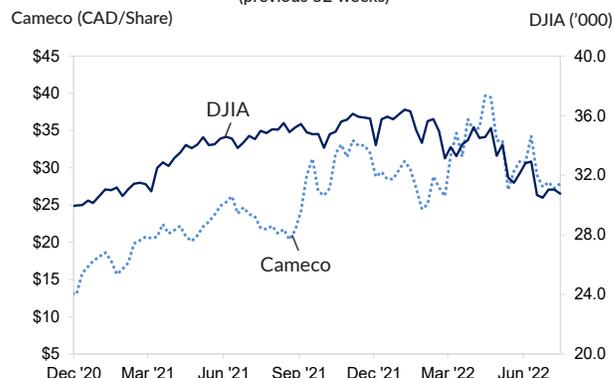
All prices as of Thursday, July 14, 2022

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



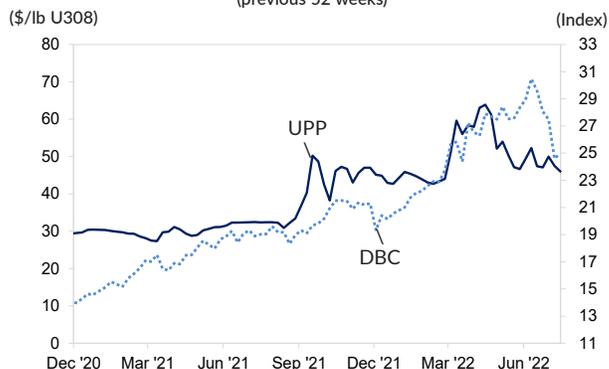
The Solactive Global Uranium Total Return Index, created by Structured Solutions AG, tracks the price movements in shares of companies active in the uranium mining industry. Calculated as a total return index and published in US\$, its composition is ordinarily adjusted twice a year.

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



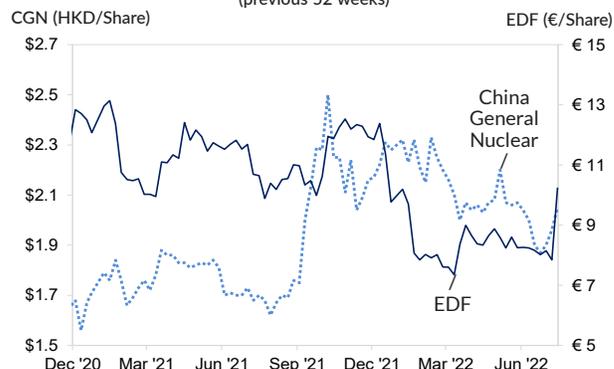
Canadian uranium miner Cameco's stock is valued in Canadian dollars compared with the US dollar on the Dow Jones Industrial Average (DJIA). Roughly two-thirds of DJIA's 30 component companies are manufacturers of industrial and consumer goods. The others represent industries ranging from financial services 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					
		Jun	May	Apr	Mar	Feb	Jan	Dec	Nov	Oct	Sep	Aug	Jul
Uranium (\$/lb U3O8)													
Low	+1.00	45.50	46.00	52.50	51.00	42.50	43.00	42.00	43.00	36.00	36.00	32.20	32.20
High	-1.50	52.50	54.00	64.00	60.00	44.50	46.50	47.00	47.50	48.00	51.00	36.00	32.50
Conversion (\$/kgU)													
Low	-	30.00	30.00	28.00	26.00	16.00	16.00	16.00	15.00	16.00	19.00	19.00	19.50
High	-	33.00	33.00	30.00	28.00	17.00	17.00	17.00	18.00	19.00	21.00	21.00	21.50
Enrichment (\$/SWU)													
Low	-	84.00	84.00	82.00	100.00	59.00	57.00	56.00	56.00	55.50	55.50	54.00	54.00
High	-	150.00	150.00	150.00	150.00	61.00	59.00	57.00	57.00	57.50	57.50	56.00	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.

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