

NUCLEAR INTELLIGENCE WEEKLY[®]

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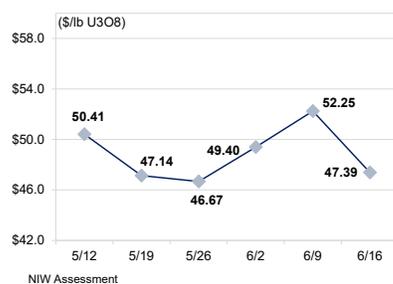
Market Points

Seeking to diversify away from Russia, Czech utility CEZ is collecting bids for 10 years of enriched uranium product supply for its Temelin plant, while Bulgaria's NEK and Slovakia's Slovenske Elektrarne are looking for indicative proposals.

The uranium spot market took another dip this week on rising economic concerns and weak offers, with the uranium price delivered by Energy Intelligence's Uranium Price Panel down to \$47.39 per pound U3O8 on Jun. 16, from \$52.25/lb. on Jun. 9.

And in China, CGN Mining, the subsidiary of China General Nuclear Power Corp., did a 40% fixed price and 60% market price deal with its parent company for a minimum of 3.12 million lbs. U3O8 per year for 2023-25.

UPP: \$47.39/LB U3O8



WEEKLY ROUNDUP

Olkiluoto-3 Faces Year-Long Start-Up

- Olkiluoto-3, Europe's first-of-a-kind EPR, is now slated to start regular electricity production into the Finnish grid in December, a full year after it reached first criticality on Dec. 21, 2021. Owner TVO had at that time projected regular electricity production — the final milestone in the commissioning process — for June 2022, but in the months since technical issues have repeatedly pushed the schedule back. The latest delay came after a May inspection found "foreign material" in the turbine's steam reheater, apparently "detached from the steam guide plates," requiring "inspection and repair work," TVO said in a Jun. 15 statement. "According to investigations from the plant supplier, the repair work will last until the end of July." Only after can the test ramp up of the EPR continue, TVO explained, and given "previous experiences" it is now budgeting additional time for the subsequent testing period. It's not yet clear what this means financially, either for TVO or for the Olkiluoto-3 supplier consortium of France's Areva SA and Germany's Siemens. TVO emphasized that the consortium "is obliged to complete the plant" in accordance with both the initial plant contract — from nearly two decades ago — and from a 2018 settlement that attempted to resolve previous delay-related disputes between TVO and the supplier consortium.
- Two European Parliament committees this week approved an objection to a proposed EU classification of some natural gas and nuclear power projects as "sustainable," and thus eligible for "green" funding. The joint Jun. 14 vote of the parliament's economic and environmental committees saw 76 votes in favor of the objection, 62 votes opposed and four abstentions. If an absolute majority of 353 members of parliament similarly back the objection in a vote during the parliament's next plenary session, from Jul. 4-7, the European Commission's effort to include natural gas and nuclear within the bloc's "green taxonomy" will likely be over. When the commission introduced the draft law in January, it argued that the two technologies will play an important — if temporary — role in the EU's energy transition.
- The Japanese Supreme Court today absolved the national government of liability to compensate victims of the March 2011 Fukushima Daiichi disaster. The landmark Jun. 17 verdict is expected to impact up to 30 related class-action suits by forced evacuees from the affected areas against Tokyo Electric Power (Holding) Co., or Tepco, and the Japanese state. A four-judge panel of the Supreme Court's second petty court issued a combined verdict on four lawsuits on appeal from high courts in Fukushima, Gunma, Chiba, and Ehime. In March, the Supreme Court had ordered Tepco to compensate the 3,700 plaintiffs involved in the four lawsuits. The court concluded that the magnitude 9.0 Great Tohoku Earthquake had been far greater than the magnitude 8 earthquakes forecast by the Cabinet-level National Headquarters for the Promotion of Earthquake Research in 2002, and that the resulting tsunami had been similarly larger than predicted. A 3-1 majority therefore found that the disaster could not have been prevented even if the government had ordered Tepco to adopt stronger tsunami countermeasures, NHK reported.

NUCLEAR FUEL MARKET

Traders and Fundamentals Nudge Price Lower

The uranium spot price took another dip this week as market participants pointed to lower offers from traders, indicating they had run the price down to collect a discount on pounds delivered under certain offtake agreements. Other market sources, meanwhile, noted broader economic fundamentals such as rising inflation and Chinese import data showing a slowdown in trade.

The spot price delivered by Energy Intelligence’s Uranium Price Panel slipped to \$47.39 per pound U3O8 on Jun. 16, down 9% from the previous week’s price of \$52.25/lb., delivered Jun. 9.

The uranium spot price toggled between offers at \$47/lb. and \$47.75/lb. during the week, with deals concluded at both ends. Sprott Asset Management’s uranium trust, Sput, picked up 200,000 lbs. on Jun. 16, bringing its physical uranium holdings to 56.5 million lbs. U3O8. Sput’s share price, however, has slumped below its net asset value since Jun. 8, limiting the fund’s ability to raise more cash to buy more uranium.

Amid a number of off-market discussions across the supply chain, enrichers are seeing the most robust interest. Western enrichers in particular are seeing traditional buyers of Russian fuel hoping to lock in new long-term contracts. Czech utility CEZ is collecting bids for 10 years of enriched uranium product supply for its Temelin plant, and Bulgaria’s NEK and Slovakia’s Slovenske Elektrarne are looking for indicative proposals, with each seeking to diversify away from Russia, according to one supplier.

Meanwhile, in the US, the Department of Energy is in talks with congressional staff to fund an effort to wean US utilities off Russian supply, indicating the Biden administration may cut off Russian nuclear fuel imports. In the near term, that would likely require working with enrichers from allied nations and ramping up future conversion capacity in the US.

If those two steps can be achieved, it would likely accelerate the production of US brownfield uranium mines and the development of some greenfields. US mining juniors have already managed to

secure some offtake contracts with US utilities at an industry conference last week in Montreal.

With Congress poised to shift to Republican control in the November primary elections, Wyoming Republican Sen. John Barrasso is all the more likely to direct new government support to US uranium juniors. Barrasso is currently ranking member of the Senate Environment and Natural Resources Committee while influential moderate Democrat Sen. Joe Manchin is the chair. Those roles would likely be reversed if Republicans take back control of the Senate, and unlike Manchin, Barrasso has uranium assets in his home state.

And it’s not just US mining juniors that stand to benefit from a market increasingly bifurcated between Russian and non-Russian supplies. Canadian mining junior Global Atomic Corp. this week announced it received a letter of intent from a major North American utility to procure 2.1 million lbs. U3O8 from 2025–30 from its underground mine project in Niger. “The award follows a comprehensive due diligence process conducted by the utility, and reflects the confidence the fuel buyers have in the Dasa operation,” Global Atomic said in a Jun. 15 statement.

Global Atomic made “a production decision” in November last year to proceed with its 90% owned Dasa at an estimated \$208 million capital cost, following a phase-one feasibility study that put all-in sustaining costs at \$21.95/lb. for 3.8 million lbs. annually over 12 years. Global Atomic hopes to commission a processing plant in 2024.

And in China, CGN Mining, a Hong Kong-listed subsidiary of China General Nuclear, did a deal with its parent company for a minimum of 3.12 million lbs. U3O8 per year for 2023–25, according to a Jun. 16 statement. The price terms of the deal amount to a mix of 40% of fixed prices, or current forecast prices for 2023–25, plus 60% of future spot market prices for the same period, with a multiplier for inflation in 2024 and 2025. The fixed price aspect of the deal indicates that if the spot price increases substantially during that period, the customer will still receive a discount to that future price.

Jessica Sondgeroth, Washington

URANIUM PRICE PANEL

For the week ended June 16, 2022

	Chg.	Weekly Spot Market Prices													
		June			May					Apr			Mar		
		16	9	3	26	19	12	5	28	21	14	7	31	24	
Price (\$/lb U3O8)	-4.86	47.39	52.25	49.40	46.67	47.14	50.41	54.00	52.13	61.28	63.88	63.07	57.94	58.34	
Total Assessments	1.00	11.00	10.00	10.00	12.00	10.00	9.00	11.00	9.00	10.00	10.00	9.00	10.00	9.00	
% within 1 StDev	2.73	72.73	70.00	40.00	75.00	80.00	77.78	72.73	55.56	60.00	90.00	77.78	80.00	66.67	
Low (\$/lb U3O8)	-5.10	46.60	51.70	49.00	46.00	47.00	49.00	53.50	51.25	59.00	63.75	63.00	57.50	58.00	
High (\$/lb U3O8)	-4.00	48.50	52.50	50.15	47.50	47.50	52.00	55.00	53.00	63.25	64.00	63.50	58.75	58.50	
Variability*	-0.31	0.09	0.40	0.32	0.05	0.00	0.28	0.50	0.50	0.75	0.08	0.00	0.28	0.13	

*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

Congress Weighs Federal Role in Nuclear Fuel Procurement

The possibility of launching a domestic US nuclear fuel bank to guarantee US utilities a supply of non-Russian low-enriched uranium (LEU), which was recently proposed by the US Department of Energy (DOE) to legislators in Congress, comes as the Biden administration continues efforts to secure high-assay low-enriched uranium (Haleu) for a planned advanced reactor program. The DOE push on Capitol Hill indicates the Biden administration intends to at some point halt Russian nuclear fuel imports, which remains an unused policy lever in its escalating response to Russia's continued invasion of Ukraine.

Washington was already working on policies to supersede Russia and China in the race for dominance in the global nuclear energy market before the Ukraine invasion in late February exacerbated the growing geopolitical rift, elevating to an urgent priority the security of nuclear fuel supply for US operators and advanced reactor developers. Whereas the DOE, prior to February, would have allowed advanced reactor vendors to purchase Haleu from Rosatom enrichment subsidiary Tenex, the agency must now secure a non-Russian source and that effort could extend to LEU for the operating reactor fleet. The geopolitical conflict has given the DOE leverage to ask for more funding and its effort is likely to enjoy receptive bipartisan support in Congress.

While the nuclear fuel market may have mixed reactions to any move by the DOE to play an active role in procuring and selling nuclear fuel, the measured approach by members of Congress and the DOE seeks to avoid harming the US nuclear fleet with an abrupt interruption to Russian supply at roughly one-fifth of US demand.

To do that, the DOE seeks to revitalize domestic nuclear fuel supplies by using as leverage federal supply or cost-share contracts. The DOE has suggested to Congress it would need \$4.3 billion to buy nuclear fuel, across the supply chain, to help divert US utilities off of Russian nuclear fuel and to procure Haleu for its two advanced reactor demonstration projects.

Manchin Bill

The DOE-supplied \$4.3 billion figure was essentially a bid to enlarge the \$3.5 billion line item for a Nuclear Fuel Security Program in legislation introduced on Apr. 8 by powerful centrist Democrat Sen. Joe Manchin and Sen. James Risch, an Idaho Republican.

The International Energy Act of 2022 requests \$3.5 billion in fiscal year 2023 to remain available to September 2031 "to reduce the reliance of the United States and ally or partner nations on nuclear fuels from the Russian Federation and the People's Republic of China."

The Nuclear Fuel Security Program would be tasked with "increasing the amount" of LEU for existing reactors and Haleu for advanced reactors "produced by US nuclear energy companies." Given the limited availability of domestic fuel production in the US, the definition of a US energy company is likely to be interpreted broadly and extended to entities owned by companies in allied nations.

DOE spokesperson Karla Olsen told Energy Intelligence the agency is providing "technical assistance to Congress on options available to meet the intent" of the bill, but didn't break down the math behind the \$4.3 billion figure. The Nuclear Energy Institute (NEI), a Washington-based industry group, told Energy Intelligence it estimates "it will take around \$3.5 [billion]-\$5 billion to develop a program that will create a diverse, competitive nuclear fuel market that would expand domestic fuel-cycle capabilities." At any price, the already bipartisan bill has a good chance of passage, even if Republicans gain back control of the US House and Senate in the November midterm elections, as polls indicate.

LEU and the Conversion Bottleneck

Sources suggest the DOE program could procure 100 metric tons of LEU per year, a mere fraction of US reactor demand, for 10 years: at current term prices near \$2,400 per kilogram and that alone would cost a total of \$2.4 billion.

This prospect prompted much speculation from the nuclear fuel industry and its customers. One US nuclear fuel buyer worried that "it appears as though" the DOE "will be competing with utilities" for conversion and enrichment contracts before then trying "to flip the material back to the utilities."

A certain portion of the funds could also go into cost-share agreements for additional capacity that the DOE could theoretically contract. That might make particular sense for the procurement of conversion services.

Any effort to siphon off Russian supply to the US would first involve enrichers Orano in France and European consortium Urenco, with plants in the US and Europe. Orano and Urenco would likely switch their operations to overfeeding. But overfeeding — ramping up tails assays and LEU output without changing the number of centrifuges — would require more non-Russian UF6 as feedstock than is currently available. And as the two operating Western UF6 operations — Cameco's Port Hope plant in Canada and Orano's Comurhex II complex in France — are already operating at or near capacity, the DOE may be tempted to enter a cost-share agreement to expand output capacity at Honeywell's Metropolis plant, in the US state of Illinois, when it restarts production next year.

Metropolis is scheduled to come on line by the end of March 2023 at 7,000 tU capacity, with most of those volumes already contracted. Metropolis parent companies General Atomics and Honeywell, as well as their conversion marketing joint venture ConverDyn, have been evaluating the cost and risk of scaling up plant capacity

further. With funding from Congress, the US government could play a role in helping Metropolis make the more than \$50 million in capital expenditures it needs to further increase capacity. But there's a catch: a move to increase plant capacity would likely delay the plant's start-up by up to a year.

That's a long time in an already tight market. Even before the prospect of a halt to Russian LEU imports, US utility inventories of UF₆ declined by 12% in 2021 to 36.4 million pounds of U₃O₈ equivalent, according to the US Energy Information Administration's annual uranium marketing report.

Haleu Procurement

For the Haleu portion of the procurement program, the DOE could potentially secure just enough Haleu (25–30 metric tons) from the DOE's quasi-independent National Nuclear Security Administration (NNSA) to demonstrate its two Advanced Reactor Demonstration Project reactors: TerraPower's 345 megawatt sodium-cooled fast reactor, Natrium, and X-energy's high-temperature gas-cooled reactor, the Xe-100.

One source estimated that cost at \$160 million–\$200 million, but the NNSA would have to be encouraged by Congress to part with about 6 tons of its highly enriched uranium inventory for downblending into Haleu. Other estimates for the Haleu for downblending range closer to \$450 million–\$550 million.

That doesn't include longer-term Haleu requirements, estimated by the NEI at about 700 metric tons by 2030. A producer source estimates that DOE currently pays about \$20,000 per kilogram for Haleu for its research reactors. At 700 metric tons of Haleu, the price tag based on those figures rises to \$14 billion quickly. But the DOE may be happy to see its two advanced reactors through and let the market determine future demand requirements on its own.

Jessica Sondgeroth, Washington

UNITED KINGDOM

Whitehall Advances Sizewell C and Rab

Whitehall this week certified the EDF-led Sizewell C project company to access a ratepayer-backed financing scheme, while at the same time positioning itself to implement long-telegraphed plans to buy out a subsidiary of China General Nuclear (CGN) from its 20% stake in that newbuild firm.

The regulated asset base (Rab) company designation unveiled this week by the UK Department of Business, Energy and Industrial Strategy (BEIS), alongside further details as to how Rab will be

implemented, is meant to enable EDF to attract further equity and debt investors for Sizewell C, which aims to build twin-EPR reactors at the Sizewell plant in Suffolk. And while that designation only discussed the government's intention to take a "special share" in the Sizewell C project company in order to protect "national security interests," broader government messaging pointed to an intention to push out CGN, which many in Westminster and Washington believe is too intertwined with China's military nuclear program.

"Protecting national security is our top priority," BEIS Secretary Kwasi Kwarteng said in a Jun. 15 tweet. "We're set to approve eight reactors this decade — we must have peace of mind."

The exact mechanics of how this will happen remain unclear, but the government's January announcement that it would take a £100 million stake in the Sizewell C project company set the plan in motion. That's only a fraction of the £1.7 billion the government has committed to spending on a large nuclear project, however the larger sum may be set aside to fund construction via a 20% equity stake. Using back-of-the-envelope calculations, a pro-rated £1.7 billion contribution from a 20% equity owner would imply a total equity contribution — from 100% of the company's shareholders — of £8.5 billion, or roughly 42.5% of the ballpark £20 billion total Sizewell C cost that has been reported. That would imply debt financing for 57.5% of the construction costs, which isn't unrealistic.

How exactly the UK government would buy out the CGN subsidiary that currently owns a 20% stake in the Sizewell C project company remains unclear, as does CGN's willingness to sell. But between the government's "special share" and the anti-Chinese sentiment in Whitehall and Westminster, few doubt that this will be accomplished.

The more fundamental question, as always, is how EDF proposes to attract debt financing and further equity shareholders. With both the government and EDF stakes in the Sizewell C project company likely capped at 20% each, EDF needs to attract equity investors for the other 60%, and these investors must be willing to inject some £5.1 billion in equity alongside whatever construction risk remains under the Sizewell C-specific Rab arrangements.

Filling in the Details

While BEIS launched a consultation this week on the revenue collection mechanism for the nuclear Rab, this still avoided the details likely of most interest to both the public and to prospective investors: the exact allocations of construction risk between investors, ratepayers and taxpayers.

Some of this may be filled in via secondary legislation likely to go before Parliament later this year. And yet it's likely that some of the most sensitive risk allocations — such as a long-promised government support package intended to protect investors from one-off macro risks such as pandemics, rapid currency movements, etc. — may only be detailed in nonpublic contracts

between the Sizewell C project company and various counterparties, such as the Rab-designated regulator Ofgem, the Office of Gas and Electricity Markets. If prospective investors remain as wary as they currently seem, the question will be whether the government succumbs to the temptation to expand its support package to include less exceptional nuclear construction risks, of which there are many.

What was actually delineated by the government this week was how companies designated under the nuclear Rab scheme — the Sizewell C project company is the first, but will likely not be the last if the project is successful — will receive their revenues, and how those revenues will be collected. The key actor here will be the Low Carbon Contracts Co. (LCCC), which performs the same role for projects under the separate contracts-for-difference (CFD) scheme. Under that scheme, which will be used to collect revenues from the twin EPRs under construction at EDF's Hinkley Point C, the LCCC collects the difference between the contracted project "strike price" and the market electricity price. It collects those funds from a "supplier levy" on electricity suppliers across the UK — but not Northern Ireland, which doesn't benefit from any of the electricity produced. That levy is pro-rated according to market share.

Under the nuclear Rab, the LCCC will similarly collect revenues via a supplier levy, according to rates set by Ofgem. While the nuclear project is under construction, the supplier levy will supply the entire revenue stream, but once operational it will only supply the difference between what is earned via the kilowatts sold to the market and what is allowed by the Ofgem-set rate.

Beis' decision to implement the nuclear Rab just as it does the CFD scheme is an interesting echo of EDF's intention to replicate as much as possible the design and supply chains of Hinkley Point C at Sizewell C. BEIS emphasizes again and again the benefits of replication: just as it and EDF argue that project-to-project replication will help derisk Sizewell C, BEIS seems to be arguing that subsidy scheme-to-subsidy scheme replication will derisk the entire nuclear Rab framework.

Beyond Baseload Power Production

Such arguments may attract some investors, but BEIS and EDF are also eager to tout Sizewell C-specific initiatives. In its extensive but nonpublic calculations of Sizewell C's value-for-money, BEIS assumed that the plant would be used only for baseload electricity generation. But the government department notes that other options are possible, such as load-following that would ramp Sizewell C's output up and down, depending on system demand.

"While this has never been done with a nuclear power station in the UK, EDF operates a number of its reactors in France on a load-following basis, and the EPR technology that Sizewell C uses is technically capable of operating in this manner," said BEIS. "If pursued, a load-following approach could have benefits to the electricity system, reducing system operator costs by adding a flexible tool for responding to changes in electricity demand."

BEIS also highlighted the possible use of excess heat from the steam produced at Sizewell C for hydrogen production or for direct air capture (DAC) of carbon dioxide.

Indeed, the Sizewell C project company is already part of a consortium of companies in the running to win government funding under the £70 million BEIS program to develop DAC technologies. Under the consortium's pitch for a Sizewell C DAC plant, a larger DAC plant hooked up to Sizewell C could use up to 400 megawatts of thermal heat from the twin EPRs to capture 1.5 million tons of CO₂ per year.

BEIS noted that this would be enough to almost offset all of the UK's emissions from railway transport, although EDF might prefer to point to the captured CO₂ as offsetting the carbon footprint of Sizewell C's construction. But such offsetting is likely premature. In its designation this week, BEIS noted that there isn't yet "enough evidence to ascertain" whether Sizewell C could provide a "low-cost option" for DAC or hydrogen production.

Phil Chaffee, London

IRAN

What Might Come Next as Relations Unravel?

Iran's decision last week to remove 27 monitoring cameras in response to a Western-backed resolution by the International Atomic Energy Agency (IAEA) criticizing its failure to cooperate was a major setback for stalled efforts to revive the 2015 nuclear deal.

This came amid rising tensions with Israel and the US, stoked by the suspected assassination of Iranian scientists and senior military officials and tit-for-tat oil tanker seizures. The war in Ukraine and unprecedented Western sanctions pressures, meanwhile, are pushing Russia and Iran closer. Energy Intelligence weighs three possible scenarios.

- **Nuclear talks remain alive officially, with neither side willing to kill them off but the prospect of a breakthrough greatly reduced.**

This has been the case since the talks broke off without being formally suspended in March. Some expect it to remain the likeliest scenario for now (and several more months at least), given that the US administration, already battling the Ukraine crisis and sky-high oil prices, simply doesn't have the stomach for a conflagration in the Middle East.

Under this scenario, according to Behnam Ben Taleblu with US think tank the Foundation for Defense of Democracies, officials from the administration of US President Joe Biden "never really

say the talks collapsed, sporadically issue sanctions” and leave the door open. The approach, in his view, is accompanied by the conviction that more severe sanctions only encourage Iran to accelerate its nuclear activity.

Iran, for its part, has little to lose from repeating its interest in doing a good deal while blaming the US if talks fail, having found a way to keep its economy afloat under US sanctions, supported by high oil prices. Whether and for how long such a scenario is sustainable is a key question, which, for Iran’s adversaries, centers on its nuclear program.

Tehran has shown some restraint here lately, after ramping up production of uranium enriched to 20% and 60% earlier this year, although the accumulation of highly enriched material is a concern. Its Jun. 8 decision to limit the IAEA’s monitoring capability — the cameras were installed to ensure Iran abided by its commitments under the Joint Comprehensive Plan of Action (JCPOA) — was a clear departure from that policy of restraint.

Alongside other recent actions, notably Iran’s expansion of advanced centrifuge deployment and refusal to discuss undeclared nuclear material, it has undermined the idea that Tehran is genuinely interested in a deal, the Eurasia Group think tank noted on Wednesday.

Still, the blow to Iran’s economy from the formal collapse of talks could be severe. Just this week, the Iranian rial dropped to its lowest-ever value against the dollar.

• **Nuclear talks collapse, causing regional escalation after Israel takes unilateral action and Iran responds by stepping up its nuclear activity and hitting regional energy targets — further roiling oil markets.**

The five reported assassinations in Iran that began on May 22, and the capture by Iranian forces of two Greek-flagged tankers carrying Iraqi oil a few days later, in retaliation for Greece’s seizure of a Russian-flagged Iranian crude cargo at the US government’s request, suggest this scenario is already unfolding. Israel may be suspected of orchestrating the assassinations. But the breakdown in negotiations, and resulting dangers, stem from what Iran analyst Esfandiyar Batmanghelidj calls a “reinforcing escalatory dynamic in Washington and Tehran.”

With the negotiations stalled, pressure is building on Biden — not least from Israel and Saudi Arabia, both staunch JCPOA critics — to take the lead in containing Iran militarily when he visits the region in July. “In the face of Iranian belligerence ... what is needed is not just cooperation, but also a regional force buildup, with American leadership,” Reuters quoted Israeli Defense Minister Benny Gantz as saying on Tuesday. A foreign ministry spokesman confirmed that this did not refer to a new, formal joint military force.

Provoking Tehran risks a rerun of attacks on Saudi Arabia’s oil infrastructure, Israeli-owned ships, or tankers moored off Fujairah, and could choke off Iran’s flourishing trade with the

United Arab Emirates. Spillover into Yemen and Iraq is also likely.

But the calls for containment are driven by the perception of an increasingly assertive Iran. Israeli Foreign Minister Yair Lapid on Monday advised Israeli citizens to avoid Istanbul amid reports that Turkey had arrested several Revolutionary Guard “operatives” targeting Israeli tourists.

Iran has been emboldened by its relationship with Russia, whose surprise intervention in the Vienna talks three months ago knocked diplomatic efforts sideways at a pivotal moment. Russia’s Security Council chief Nikolai Patrushev stressed the need to finalize a long-term economic cooperation agreement with Tehran at a meeting in May with his Iranian counterpart. The development of the “north-south corridor” was, he said, a priority for the two countries in the face of massive Western sanctions pressure. How much it might offset even more pressure on Iran is an open question.

• **Negotiations collapse, but both sides show restraint, with the US in particular wanting to avoid further oil price spikes ahead of November midterm elections.**

IAEA chief Rafael Grossi warned last week, after Tehran’s decision to remove the 27 cameras, that within three to four weeks the UN nuclear watchdog would lose all continuity of knowledge over the Iranian program, which would be a “fatal blow” to any hopes of reviving the 2015 deal. If those hopes are finally dashed, international scrutiny of Iran’s nuclear “breakout” time — the point at which it has enough fissile material to make a nuclear weapon — will intensify. US officials have said for months that it might be just weeks away.

But that is different from Iran’s ability to actually deliver a nuclear weapon. Some experts reckon it would need another 18-24 months, which takes some of the pressure off the US to act. Unclear is whether the US can or would stop unilateral attempts by Israel to sabotage Iran’s nuclear facilities, such as the one it was accused of at Natanz last year.

The recent US decisions to blacklist individuals and companies accused of facilitating oil and petrochemical sales that benefited the Revolutionary Guard and the National Iranian Oil Co. — and continued if sporadic US efforts to intercept Iranian oil shipments — hardly encourage the view that both sides will exercise restraint. Some oil traders argue that Washington may turn a blind eye to the flow of sanctioned Iranian oil in the coming months. Claims by Iranian officials that Greece has agreed to release the confiscated cargo could also, if confirmed, offer hope that the reciprocal tanker seizures are not the start of something more serious. If they are, market turbulence could be about to get a lot worse.

Simon Martelli, London

A version of this article appeared in Nuclear Intelligence Weekly sister publication Energy Compass

IN PERSPECTIVE

Unlocking Nuclear Competitiveness With ... Competition

David Stearns, a nuclear financier and developer, argues that small modular reactors (SMRs) and advanced reactors (ARs) offer an unprecedented opportunity to introduce intra-nuclear competition, which may be the only way to achieve nuclear affordability and broader net-zero policy goals.

In its recent *Roadmap for the Global Energy Sector* report, the OECD's International Energy Agency sets out a Net-Zero Emissions (NZE) scenario for 2050. One figure pops out: 420 gigawatts, which is the recommended net addition to global nuclear capacity to achieve NZE. Current global nuclear capacity stands at 392 GW, so it needs to more than double. Given nuclear newbuild lead times of 10–20 years, policymakers should be acting now to test industry capabilities and help attract investors.

Countries that have actively engaged with the industry and challenged its marketing brochures, however, already know that it is not up for a job of this scale. Outside state-run economies, nuclear power has been the opposite of a growth story. The World Nuclear Association indicates there was an equal number of nuclear plant connections and closures — 104 and 103, respectively — between 1999 and 2020.

Although the industry's operating track record over those two decades improved remarkably, in terms of safety and capacity factors, global capabilities shifted significantly from delivery to relicensing, uprates and decommissioning. Missing was the infrastructure needed to support NZE-scale growth: strong owner/operator customers, regulatory frameworks that could enable innovation, market designs that could properly remunerate new-build plants, and commercial models able to attract the massive funding required.

Meanwhile energy markets have become more competitive than ever. The toothpaste that enabled large-reactor fleet deployment in the past cannot be put back into the tube. But as the world seeks to reduce emissions, electrify transport and industry, improve grid reliability and diversify sources of primary energy, latent demand for nuclear energy has never been greater.

The Minor Revolution of SMR and ARs

This is the backdrop to the recent surge of SMR/AR vendors advancing dozens of new designs and technologies. Many have been toiling away in some form for years with a mix of private and grant funding, but their survival depends on the as-yet-unexplored pathway to market funding.

The SMR and AR business case represents a minor revolution. Until recently, the industry's cornerstone belief has been that units must grow ever-larger to be competitive. Of course, this has been repeatedly disproved. Gigawatt-scale projects in Finland, France, the US and the UK have suffered confidence-busting delays and overruns. The same vendors are among the leaders in the shift to smaller new designs.

Large-reactor fleets, and jobs, have many long, happy days ahead, with expansions, uprates, life-extensions and other work to improve economics, but de facto cartelization of the nuclear market by large reactor vendors will be over the day a new SMR or AR developer commercializes its demonstration plant. Whether, and how soon, that day arrives is mostly in the hands of governments.

The SMR/AR hypothesis requires highly replicable, largely factory-built smaller units — between 20 MW and 470 MW — to be sold in great enough numbers to offset “diseconomies” of scale relative to larger units. The tension here is between economies of scale and economies of repetition. The SMR/AR business case must strike an economic equilibrium on costs, schedule and quality that is acceptable to both the first-of-a-kind investor/customer and to mass-market, nth-of-a-kind investors/customers who require being derisked.

First-of-a-kind business risks cannot be overstated. Many designs and safety cases will be written up and reviewed for the first time. First-of-a-kind product risks will be compounded with first-of-a-kind project risks: will the SMR/AR assembly lines themselves perform? Worse, there is only limited funding available (whether venture capital or government), and market-driven timelines are extremely aggressive, with demonstration reactor commercialization as early as 2030.

A Government Role

Most first-of-a-kind designs and their prospective customers already are partly government-backed. In the future, however, nth-of-a-kind customers could be any stand-alone electricity or water/heat/storage supplier or power-intensive industrial end-user. Perhaps the most critical question for policymakers today is therefore: How much more should a government do in support of the first-of-a-kind designer in order to assure the greatest success with nth-of-a-kind customers?

A government seeking to support badly needed innovation in nuclear could consider a multistage approach.

First, avoid picking any winners by opening the early-stage design review to vendors — of reactors large and small — with credible designs and organizations. Second, provide site-bounding conditions with a broad prefinancial close funding toolkit for early-stage design review applicants according to their desire to share risks and rewards during the development phase. Third, proceed to a technical feasibility milestone test so that first-of-a-kind unit target costs, schedule, performance and the nth-of-a-kind pipeline are transparently scored and ranked. Finally, offer co-funding

for vendors that advance to the ensuing stages as they enter into commercial contracts with their customers, supply chain and financial stakeholders.

Government co-funding at any point can be calibrated using value-for-money metrics so that any early-stage taxpayer subsidies are offset over the longer term. But should government-backed revenue support form part of the incentives? Not necessarily. If the nth-of-a-kind products are sufficiently derisked, with a particularly strong demonstration project, then customers and inves-

tors will happily divvy up the relatively low costs and high benefits between themselves. Any surplus benefits would naturally accrue to government and the economy in the form of growth, jobs and taxes.

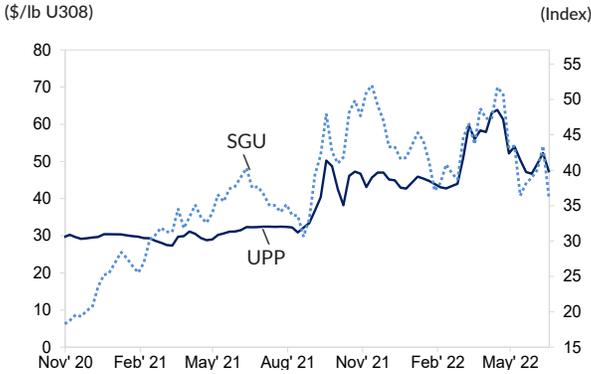
Until that stage governments should — for the benefit of their populations and of the planet — keep as many innovative nuclear vendors in the room as possible.

David Stearns, London

URANIUM MARKET UPDATE

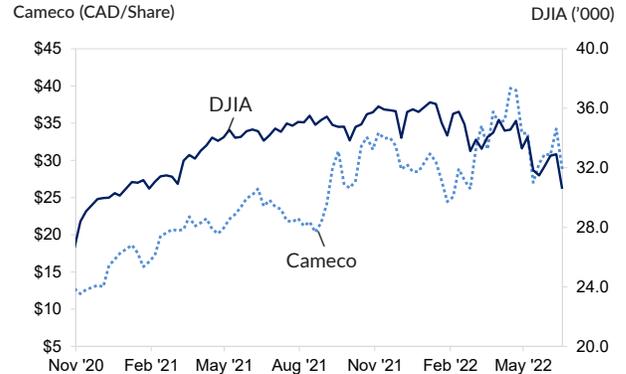
All prices as of Thursday, June 16, 2022

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



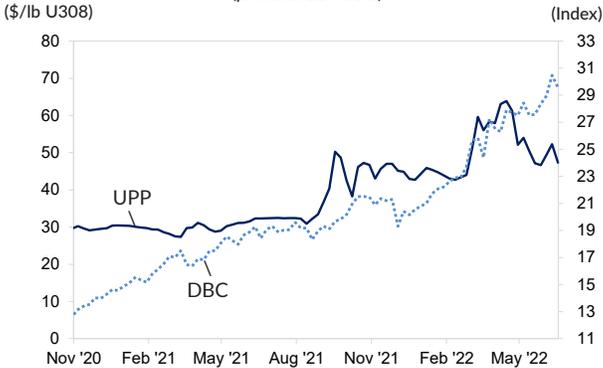
The Solactive Global Uranium Total Return Index, created by Structured Solutions AG, tracks the price movements in shares of companies active in the uranium mining industry. Calculated as a total return index and published in US\$, its composition is ordinarily adjusted twice a year.

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



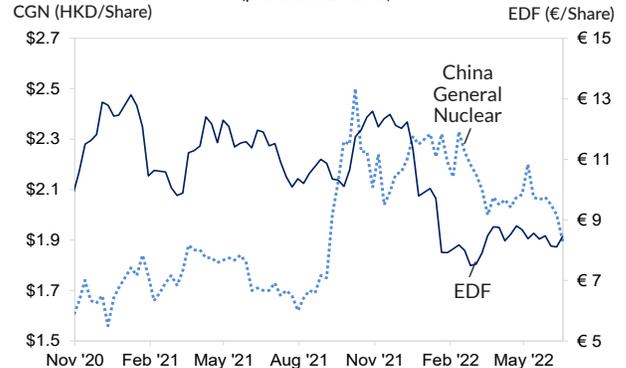
Canadian uranium miner Cameco's stock is valued in Canadian dollars compared with the US dollar on the Dow Jones Industrial Average (DJIA). Roughly two-thirds of DJIA's 30 component companies are manufacturers of industrial and consumer goods. The others represent industries ranging from financial services 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						
		May	Apr	Mar	Feb	Jan	Dec	Nov	Oct	Sep	Aug	Jul	Jun
Uranium (\$/lb U308)													
Low	-6.50	46.00	52.50	51.00	42.50	43.00	42.00	43.00	36.00	36.00	32.20	32.20	31.00
High	-10.00	54.00	64.00	60.00	44.50	46.50	47.00	47.50	48.00	51.00	36.00	32.50	32.50
Conversion (\$/kgU)													
Low	+2.00	30.00	28.00	26.00	16.00	16.00	16.00	15.00	16.00	19.00	19.00	19.50	19.50
High	+3.00	33.00	30.00	28.00	17.00	17.00	17.00	18.00	19.00	21.00	21.00	21.50	21.50
Enrichment (\$/SWU)													
Low	+2.00	84.00	82.00	100.00	59.00	57.00	56.00	56.00	55.50	55.50	54.00	54.00	54.00
High	-	150.00	150.00	150.00	61.00	59.00	57.00	57.00	57.50	57.50	56.00	56.00	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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