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# ESA 2022 Annual Report: Deliveries & Fuel Loadings Fall as Russian Supplies Continue

On October 13, the Euratom Supply Agency (ESA) published its 2022 Annual Report, which provides an update on nuclear fuel developments in the European Union (EU) and around the world, as well as an overview of the Agency’s operations among other topics. The Annual Report takes into consideration a number of changes in the energy policies of several EU countries as well as impacts of the war in Ukraine on the fuel markets.

According to ESA, at the end of 2022, there were 103 operating reactors in 13 EU member states – note that the UK is no longer included in the ESA data. In total, 1,602 tU of fresh fuel was loaded in EU reactors in 2022 with an average enrichment assay of 3.93‰ and an average tails assay of 0.20‰. ESA states that total fuel loaded into EU reactors in 2022 amounted to 10,993 tU (~28.6 million pounds U<sub>3</sub>O<sub>8</sub>e) of natural uranium equivalent plus 57 tU (~0.15 million pounds U<sub>3</sub>O<sub>8</sub>e) of reprocessed uranium (RepU) as feed, with total enrichment usage of 8.3 million SWU. In comparison, ESA reported that 2,197 tU of fresh fuel was loaded into EU reactors

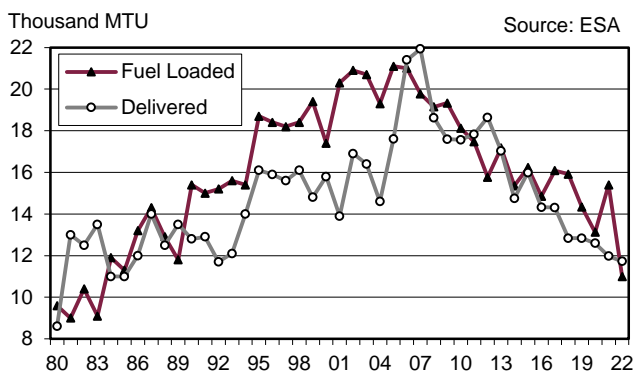
Ux Price Indicators <a href="#">Click for Market Page</a>					
Weekly Ux U <sub>3</sub> O <sub>8</sub> Prices (10/23/23)					
Ux U <sub>3</sub> O <sub>8</sub> Price <sup>®</sup>	\$73.00 (+\$4.00)	CVD Price	\$73.00 (+\$4.00)		
CMC Price	\$73.00 (+\$4.00)	ORO Price	\$73.00 (+\$4.00)		
Month-End Ux Prices (9/25/23)					
U <sub>3</sub> O <sub>8</sub>	Ux U <sub>3</sub> O <sub>8</sub> Price <sup>®</sup>	\$70.00	NA Spot	\$40.75	
	CMC [Cameco]	\$70.00	NA Term	\$31.00	
	CVD [ConverDyn]	\$70.00	EU Spot	\$40.75	
	ORO [Orano]	\$70.00	EU Term	\$31.00	
	Spot MAP*	\$64.56	UF <sub>6</sub> Spot	NA Price	\$223.50
	3-Yr Forward	\$75.00	UF <sub>6</sub> Spot	NA Value*	\$223.65
SWU	5-Yr Forward	\$79.00	UF <sub>6</sub> Spot	EU Value*	\$223.65
	Long-Term	\$61.00	EUP	NA Spot*	\$3,145
	Spot	\$138.00	EUP	NA Term*	\$2,868
	Long-Term	\$148.00			*Calculated values

## Top Stories

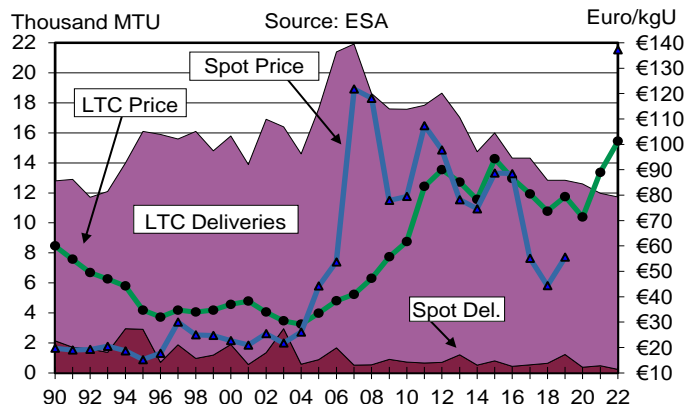
- Spot U<sub>3</sub>O<sub>8</sub> prices jumped roughly 6% over the past week as several buyers continuously bid up the market and sellers held back on offers (see page 13).
- Orano’s board voted to proceed with a 2.5 million SWU expansion of the GBII enrichment plant (see page 9).
- The new VVER-440 reactor at Mochovce 3 in Slovakia completed its commissioning phase (see page 6).
- The EC has approved Brookfield Renewables’ and Cameco’s purchase of Westinghouse (see page 8).

in 2021, equivalent to 15,401 tU (~40.0 million pounds U<sub>3</sub>O<sub>8</sub>e) plus 183 tU (~0.5 million pounds U<sub>3</sub>O<sub>8</sub>e) of RepU as feed, which was enriched using 11.5 million SWU. Thus, total fuel loadings fell roughly 27% year-over-year, which is likely due to cycle timings and reactor outages/closures.

### EU Fuel Loaded vs. Deliveries Made



### Euratom Spot & LT U Prices vs. Utility Deliveries

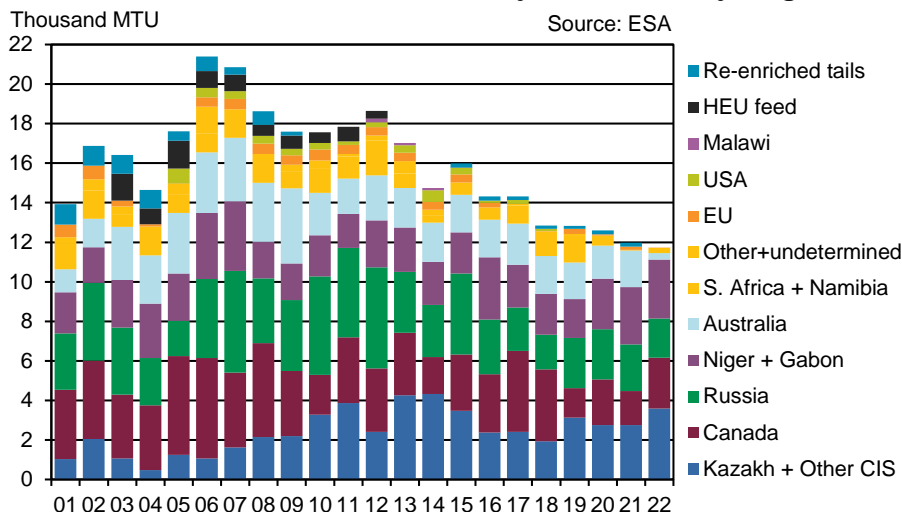


### Highlights of 2022 ESA Report

- Prices paid under long-term uranium contracts increased by 1% to US\$41.02 per pound U<sub>3</sub>O<sub>8</sub> in 2022.
- The amount of fresh fuel loaded into reactors in 2022 was 27% lower than in 2021 (1,602 tU vs. 2,197 tU).
- Uranium deliveries from Canada and Kazakhstan rose, while deliveries from Australia and Russia fell.
- SWU purchases rose 4% with increased deliveries from Urenco, Orano, as well as Russia compared to last year.
- Inventory held by utilities decreased by 3% to 35,710 tU (~92.9 million pounds U<sub>3</sub>O<sub>8</sub>e) in 2022.

ESA 2022 Annual Report is at the bottom of webpage: [https://euratom-supply.ec.europa.eu/index\\_en](https://euratom-supply.ec.europa.eu/index_en)

### Purchases of Natural Uranium by EU Utilities by Origin



**EU Uranium Supply** – ESA notes that EU utilities purchased 11,724 tU (~30.5 million pounds U<sub>3</sub>O<sub>8</sub>e) in 2022 under 119 deliveries. Deliveries were split into long-term contracts accounting for 11,493 tU (~29.9 million pounds U<sub>3</sub>O<sub>8</sub>e), or 98% of the total, and the remaining 2% under spot contracts for just 231 tU (~0.6 million pounds U<sub>3</sub>O<sub>8</sub>e). In comparison, the amount of uranium delivered in 2021 was 11,975 tU (~31.1 million pounds U<sub>3</sub>O<sub>8</sub>e) based on deliveries under long-term (96%) and spot contracts (4%).

Concerning sources of uranium supply, ESA reports that Kazakhstan and Niger were the top two country suppliers to the EU in 2022. Kazakhstan delivered 3,145 tU (~8.2 million pounds U<sub>3</sub>O<sub>8</sub>e) for a 26.8% market share, which represents a 14.2% increase from 2021. Niger delivered 2,975 tU (~7.7 million pounds U<sub>3</sub>O<sub>8</sub>) for a 25.4% share, which is an increase of 2.4% from 2021. Canada delivered 2,578 tU (~6.7 million pounds U<sub>3</sub>O<sub>8</sub>) accounting for a 22.0% market share, which is a significant increase of 50.2% from 2021. The fourth largest country supplier in 2022 was Russia delivering 1,980 tU (~5.1 million pounds U<sub>3</sub>O<sub>8</sub>), accounting for a 16.9% market share in 2022, which marks a 16.0% decrease from 2021. Uzbekistan was the fifth-largest country supplier to the EU, seeing its delivery volumes rebound from zero in 2021 to 441 tU (~1.1 million pounds U<sub>3</sub>O<sub>8</sub>) in 2022 for a 3.8% market share. Finally, Australia saw a huge decrease of 82% in deliveries to the EU in 2022 at just 327 tU (~0.9 million pounds U<sub>3</sub>O<sub>8</sub>), accounting for 2.8% of the total market. Combined deliveries from Namibia/South Africa increased to 262 tU (~0.7 million pounds U<sub>3</sub>O<sub>8</sub>) in 2022 for a 2.2% market share.

**Reported Uranium Prices** – ESA reported that in 2022 long-term (multi-annual) contracts for natural uranium delivery accounted for 98% of total deliveries with the remaining 2% purchased under spot contracts.

The average price under long-term contracts was €101.28/kgU (US\$41.02 per pound U<sub>3</sub>O<sub>8</sub>) in 2022, which is up 14% compared to 2021 in terms of euros, but only up 1.3% in terms of U.S. dollars. For comparison, the average price paid in 2021 under long-term contracts was €89/kgU (US\$40.49 per pound U<sub>3</sub>O<sub>8</sub>). Concerning prices under spot contracts, the average price was €137.26/kgU (US\$55.59 per pound U<sub>3</sub>O<sub>8</sub>) in 2022. In 2021, ESA did not report a spot price “because there were not enough transactions (less than 3) to calculate the index.” Next, ESA’s MAC-3 price index (Natural Uranium Multian-

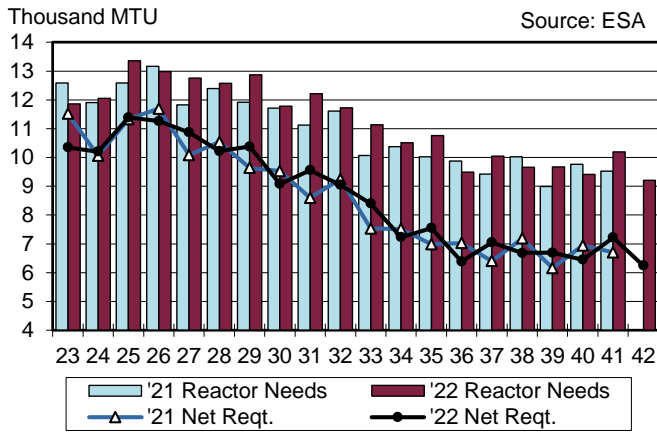
Supply of Conversion and Enrichment Services to EU Utilities					
Source: ESA					
	2021		2022		2021/2022
Conversion	Quantity (tU)	Share (%)	Quantity (tU)	Share (%)	Change (%)
Orano (EU)	3,723	31%	4,083	37%	+10%
Rosatom (Russia)	3,039	25%	2,444	22%	-20%
Cameco (Canada)	3,095	25%	2,314	21%	-25%
ConverDyn (U.S.)	1,695	14%	1,782	16%	+5%
Unspecified	584	5%	311	3%	-47%
<b>Total</b>	<b>12,137</b>	<b>100%</b>	<b>10,934</b>	<b>100%</b>	<b>-10%</b>
Enrichment	Quantity (tSWU)	Share (%)	Quantity (tSWU)	Share (%)	Change (%)
Orano/GBII and Urenco (EU)	6,385	62%	6,678	62%	+5%
TENEX/TVEL (Russia)	3,190	31%	3,239	30%	+2%
Other	715	7%	815	8%	+14%
<b>Total</b>	<b>10,290</b>	<b>100%</b>	<b>10,732</b>	<b>100%</b>	<b>+4%</b>

nual Contract) was €76.19/kgU (US\$30.86 per pound U<sub>3</sub>O<sub>8</sub>) in 2022, which is curiously down 18% from €92.75/kgU (US\$42.17 per pound U<sub>3</sub>O<sub>8</sub>) reported in 2021.

**EU Conversion Supply** – In 2022, the supply of conversion services to EU utilities totaled 10,934 tU, down 10% from 12,137 tU delivered in 2021. As seen in the above table, the biggest conversion supplier to EU utilities was Orano with 4,083 tU (37.3% market share in 2022 vs. 30.7% in 2021), followed by Russia delivering 2,444 tU (22.3% market share in 2022 vs. 25% in 2021). Cameco was the third largest supplier to the EU with 2,314 tU (21.2% market share in 2022 vs. 25.5% in 2021). Finally, ConverDyn supplied 1,782 tU (16.3% in 2022 vs. 13.4% in 2021).

**EU SWU Supply** – Concerning SWU deliveries, ESA reports that EU utilities purchased approximately 10.73 million SWU in 2022 compared to 10.29 million SWU in 2021, for a 4% increase year-on-year (see table above for details). EU utilities opted for an average enrichment assay of 4.22% and an average tails assay of 0.19% in 2022. Regarding the origin of enrichment services, 62% of EU requirements in 2022 were met by Orano and Urenco, which together supplied 6.7 million SWU for a 62% market share (compared to 6.4 million SWU in 2021). Russia was the next largest SWU supplier to

### EU Uranium Requirements as of 2021 and 2022



the EU in 2022 at 3.2 million SWU for a 30% market share (3.2 million SWU in 2021 for a 31% market share).

**MOX Fuel** – The total quantity of MOX fuel loaded in EU reactors was 3,007 kg Pu in 2022, which is a decrease from the 4,859 kg Pu used in 2021, resulting in an estimated savings of 277 tU (~1.1 million pounds U<sub>3</sub>O<sub>8e</sub>) and 0.2 million SWU. ESA notes that the only EU reactors that loaded MOX fuel in 2022 were in France and Netherlands.

**Future Requirements** – Concerning reactor requirements for the 2023-2032 period (see chart on top of this page). ESA reports average net annual requirements (i.e., after savings from planned MOX or RepU usage) for natural uranium of 10,236 tU (~27.4 million pounds U<sub>3</sub>O<sub>8e</sub>) and average net annual SWU requirements of 8.7 million SWU. As for the period 2033-2042, average net annual uranium requirements reach 6,989 tU (~18.6 million pounds U<sub>3</sub>O<sub>8e</sub>) and average net annual SWU requirements are 5.6 million SWU. Based on this data, ESA noted that “compared with the previous year’s estimate, EU average gross reactor needs for natural uranium increased by 2%, with no change for enrichment services.” Moreover, ESA says, “This is in contrast to the pattern in earlier years, when the EU average gross reactor needs were regularly revised downwards.”

**Inventories** – At the end of 2022, total natural uranium equivalent inventories owned by EU utilities was 35,710 tU (~92.9 million pounds U<sub>3</sub>O<sub>8e</sub>), which is a slight decrease from

the 36,810 tU (~95.7 million pounds U<sub>3</sub>O<sub>8e</sub>) reported in 2021. The trend of falling EU inventories continued again in 2022 since peaking in 2013.

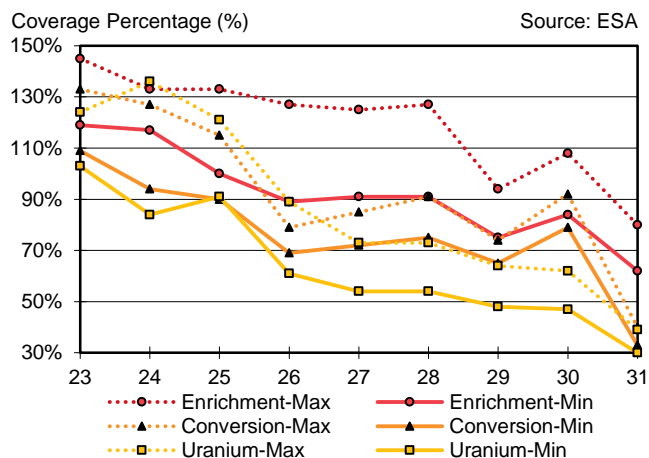
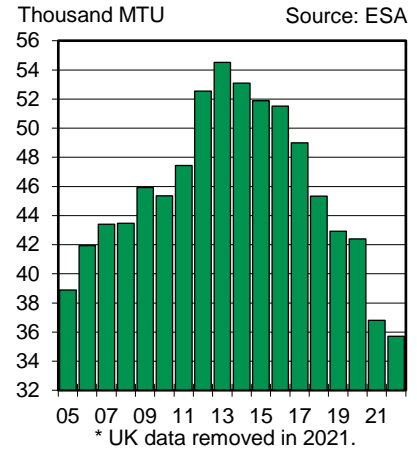
**Forward Coverage** – As seen in the bottom left chart, based on fully contracted volumes, EU utilities remain well

covered in the medium term for all nuclear fuel components (2023-2031). Concerning natural uranium, ESA shows that EU utilities’ maximum coverage rate is roughly 124% in 2023, rising to a peak of 136% in 2024, and seeing a reduction afterwards. Uranium maximum coverage falls to 121% in 2025 and drops quickly to 89% in 2026. Coverage flattens somewhat to the 70% range through 2028, but falls to just 64% in 2029. Regarding conversion, maximum total contracted coverage rates are between 133% and 115% per year during 2023-2025, but fall to 79% in 2026. However, conversion coverage rates increase overall through 2030, reaching 92% that year. For enrichment coverage, ESA reports that supply based on all existing contracts is well secured until 2028, with coverage rates ranging between 145% and 127% per year from 2023 through 2028. SWU coverage drops to 94% in 2029, rising back to 108% in 2030, before dropping to 80% in 2031.

Under minimum coverage rates, uranium coverage drops from 103% in 2023 to 91% in 2025. This downward trend continues until 2030 reaching, for example, 54% in 2027 and 30% in 2031. For conversion, minimum coverage rates show near full coverage for 2023-2024 but drop to the 60-80% range in 2026-2030 and further down to 33% in 2031. Enrichment minimum coverage rates are in the 100-119% range for 2023-2025, after which they drop to the 70-90% range in 2026-2030 and further to 52% in 2031.

**Security of Supply** – ESA’s Annual report includes a discussion on security and diversification of supply, which has gained more relevance in view of Russia’s war in Ukraine. In this context, the report informs that ESA has held talks with power utilities “most exposed to high-risk supplies.” That is utilities “dependent on the supply of fuel of Russian design or supply chain processes available only in Russia.” ESA explains that the goal of these meetings “was to discuss risk preparedness and action plan execution and to share information, concerns and market outlook.” Similar to previous years, “ESA urged the utilities concerned to expedite diversification of fuel supply and to prepare nuclear fuel diversification plans

### Total Inventories Owned by EU Utilities, 2005-2022



for fuel supply to VVER reactors.” ESA noted that “VVER-1000 reactors already had an ongoing licensing process for alternative fuel design contracted to supply as of 2024/2025.”

ESA stated, “EU utilities’ demand for both natural uranium and for fuel fabrication and related services face an increased risk related to Russian supply and connected with the new geopolitical situation.” Moreover, an ESA-led assessment of converters and enrichers indicate that “total open market conversion capacity may not be sufficient.” ESA also argues that “the capacity of the same open market sources to supply enrichment would be insufficient if the services from current non-open market players such as Russia were not available.” ESA says it will take several years to replace enrichment and conversion capacity and that the European nuclear industry needs the right signals (e.g., contracts) to increase supply capacities in friendly nations.

In view of the complex situation, ESA makes several recommendations covering various areas, including, among others, EU and domestic policy, supply of materials and services, fuel fabrication, stocks and inventories, and tendering and contractual aspects. Some recommendations concerning fuel supply include heavy emphasis on long-term contracting across all fuel cycle components (including with at least one EU-based supplier in each sector) as well as sufficient holdings of inventories (preferably within the EU territory) to allow for immediate reactor refueling in the event of a supply disruption in any part of the fuel cycle.

**Final Observations** – The 2022 ESA Annual Report was issued very late this year – historically being issued in June. This may again be due to the Agency’s efforts to assess the ongoing shifts in the European nuclear fuel market in light of Russia’s invasion of Ukraine. As discussed above, the Agency clearly has taken additional steps over the past year to deal with potential risks of supply disruptions to EU nuclear utilities due to the fallout of the war in Ukraine.

The annual drop in fuel loadings in 2022 was quite noticeable and was likely linked to recent operational challenges in France along with reactor closures in Germany and Belgium. Still, EU utilities purchased more fuel than they loaded into their reactors for the first time in eight years. But this buying was not uniform, as uranium purchases were flat, conversion purchases were way down, and enrichment purchases rose.

Meanwhile future anticipated requirements rose slightly, but they still show a net 22% drop over the coming 20 years, which reflects the ongoing expectation that numerous EU reactors will close without sufficient replacement capacity.

Ultimately, it appears as if the ESA data for 2022 belies the massive market shifts that we at UxC have been observing in the EU ever since Russia’s invasion of Ukraine last February. While prices paid are yet to rise significantly in terms of U.S. dollars and deliveries from Russia are still significant, we anticipate these trends will not hold for much longer. Let’s just hope ESA’s next report comes out earlier than October 2024 so we can see what is going on in the EU sooner.

## News Briefs

### Nuclear Power

#### RPV installed at Tianwan 7 in Jiangsu Province, China

On October 16, Russia’s Rosatom reported that China National Nuclear Corp. (CNNC) successfully installed the reactor pressure vessel (RPV) into the reactor cavity of Unit 7 at the Tianwan nuclear power plant in Jiangsu Province, China. Rosatom delivered the large 335-ton RPV as well as the plant’s four steam generators, reactor coolant pump bodies, and other major equipment to the Tianwan 7 construction site in August. Going forward, CNNC’s construction teams will install the main circulation pumps and steam generators prior to welding these components to the main circulation pipelines.

CNNC and Rosatom are jointly constructing two VVER-1200 units at Tianwan 7 & 8 under a 2018 contract. Construction officially started in May 2021 and February 2022 for Tianwan 7 & 8, respectively. The two reactors are scheduled for commissioning in 2027-2028. The project contract calls for Rosatom to supply the nuclear islands and other key equipment for the plant, while CNNC manages plant construction along with conventional islands and balance of plant installations.

#### Final steam generator placed at Changjiang 3 in Hainan, China

On October 19, China Huaneng Group (CHG) announced that contractors successfully installed the third and final steam generator into its designed position in the reactor building of Unit 3 at the Changjiang nuclear power plant in Hainan Province, China. To date, CHG and project partner China National Nuclear Corp. (CNNC) have successfully installed the three ZH-65 steam generators for the HPR-1000 (Hualong One) new build project at Changjiang 3. Going forward, the companies said they will progress through the installation process for the primary loop’s related equipment, including completing out major welding activities to link all primary components.

#### SPIC hoists CA01 module at Haiyang 4 in Shandong, China

On October 20, China State Power Investment Corp. (SPIC) announced it rigged, hoisted, and placed the massive CA01 module into the heart of Unit 4 at the Haiyang nuclear power plant in Shandong Province, China. The module weighs in at about 1,046 tons and marks the heaviest hoisting operation thus far for the site’s new CAP-1000 PWR, which is China’s adapted design of the Westinghouse AP1000. The CA01 module is a structural room system that accommodates vital reactor equipment and systems, such as the reactor pressure vessel, steam generators, voltage regulators, and main



Haiyang 4 CA01 Module  
Source: SPIC

pumps. The company noted it completed the major installation milestone in just over three hours, which was faster than the same milestone for the co-located Unit 3.

SPIC started full construction in April on the CAP-1000 at Haiyang 4. SPIC's project partner at Haiyang, China National Nuclear Corp. (CNNC), announced in January that it got a head start on the new reactor by pouring concrete into the foundation of the reactor's conventional island ahead of full construction on the nuclear island. SPIC and CNNC are actively building Units 3 & 4 at the Haiyang nuclear power plant in parallel.

### **Bruce Power files notice to begin community engagement and IA process for Bruce C NPP**

On October 20, Bruce Power notified the Canadian Nuclear Safety Commission (CNSC) and the Impact Assessment Agency of Canada (IAAC) of its intent to launch an Impact Assessment (IA) for potential new nuclear generation on the Bruce Power site at the proposed Bruce C nuclear power plant, including early community, Indigenous, and public engagement. The company said it will incorporate feedback from these early engagement activities into an Initial Project Description, which will be filed with the IAAC in early 2024.

In accordance with the Ontario government's long-term electricity framework, *Powering Ontario's Growth*, Bruce Power's pre-development work envisions the deployment of up to 4,800 MWe of additional nuclear capacity for the Bruce C nuclear power plant. This additional capacity is designed to complement the existing Bruce A and B generation facilities which are home to eight reactors.

"Canada is at an important juncture," commented Bruce Power Chief Development Officer James Scongack. "We will only be able to reverse the effects of climate change, advance a net zero future and grow our economy through investment in long-term clean electricity infrastructure. We will achieve

this by engaging people and conducting pre-development activities now so we can increase the certainty around supply options, learning from past challenges with large infrastructure projects for a better future."

### **Bruce begins removal and replacement works at Bruce 3 under MCR program**

On October 18, Bruce Power reached an important milestone in its Major Component Replacement (MCR) outage for Unit 3 at the Bruce nuclear power plant in Ontario. The event began with the removal and replacement series of key components following months of safe and successful preparation. To date, Bruce Power said workers completed the successful installation of protective shielding and 16 bulkheads to isolate Bruce 3 from the Bruce A operating units. The project, which began March 1, now shifts to the replacement of fuel channels and feeders, key reactor components that will allow Bruce 3 to operate for decades to come.

The removal and replacement of major components includes 480 fuel channels, 960 feeder tubes, eight steam generators, and many other upgrades. This work will allow Bruce Power to return Bruce 3 to service with new reactor components to supply clean energy to Ontario.

Shoreline, a joint venture between Aecon, AtkinsRéalis, and United Engineers & Constructors, will begin the Fuel Channel Feeder Replacement (FCFR) program, which sees the removal and replacement of pressure tubes, calandria tubes, and feeders inside the reactor. Shoreline completed the FCFR program for Unit 6 and has also been awarded the contract for Bruce Power's remaining MCR projects in Units 4, 5, 7 and 8. "Building on the successes of the recently completed Unit 6 MCR outage, our Unit 3 MCR outage continues to leverage innovation and improvements from MCR6," said Eric Chassard, Bruce Power Executive Vice-President, Projects and Engineering. "Shoreline Power Group will now commence work in the vault and will leverage its experience and expertise to complete this work with safety, innovation and quality."

Bruce Power's Life Extension Program started in 2016 and remains on track with inspections, refurbishment, and MCRs progressing well. Bruce 6 returned to service ahead of schedule in September and was the first of six units that Bruce Power and its partners will refurbish as part of its MCR Project between 2020 and 2033, a privately funded investment that will extend the life of the site through 2064 and beyond. Bruce Power's Life-Extension Program, which includes asset optimization across all eight operating units as part of the company's Project 2030, is expected to produce more than 7,000 MWe of clean power following the completion of the MCR Project.

## Rosatom concretes inner containment dome shell at Kursk-II 2 in Russia

On October 16, Russia's Rosatom announced it successfully completed concrete pouring and forming works to form the inner containment dome (ICO) on the VVER-TOI PWR under construction for Unit 2 at the Kursk-II nuclear power plant in Kursk, Russia. The internal containment dome is one of the plant's main safety systems, which is designed to protect the reactor building and equipment, as well as supporting pipeline penetrations and the reactor building's polar crane.

"The completion of concreting of the internal containment shell of the second power unit is one of the significant events at the Kursk NPP-II construction site," explained Andrey Osharin, First Deputy Director of Kursk-II. "This gives a start to preparations for the next stage of work in the reactor building of the second power unit – the installation of a containment prestressing system, which greatly enhances the strength of the internal containment shell."

## Hokuriku EPC aims to restart Shika 2 in Japan by early 2026

On October 20, Japanese utility Hokuriku Electric Power Co. (EPC) announced that it intends to restart Unit 2 at the Shika nuclear power plant by early 2026. Shika 2 has been offline since the Fukushima disaster in March 2011. Past concerns about an active fault underneath the reactor slowed down the restart process for the plant. However, in March 2023, Japan's Nuclear Regulation Authority (NRA) concurred with the company's assertion that an active fault was not present underneath the Shika nuclear power plant. "Quick restart of the reactor will be a great force for a stable power supply, our financial structure and decarbonization," commented Hokuriku EPC President Koji Matsuda. He said the utility aims to restart the Shika 2 between January and March of 2026. The Shika 2 ABWR has a total capacity of 1,358 MWe.

Hokuriku EPC has not yet filed an application to restart the 540 MWe BWR at Shika 1. However, Matsuda noted that the company plans to restart Unit 1 after it commences operation at Shika 2. "Once we have a clear picture of the No. 2 unit, we want to swiftly start application work on the No. 1 reactor," Matsuda told *Reuters*.

## Slovakia's Mochovce 3 attains commercial operation after completing full power testing

On October 17, Slovenské Elektrárne (SE) announced that it successfully completed a 144-hour trial run at full capacity for Unit 3 at the Mochovce nuclear power plant in Slovakia. With successful completion of the trial run at full power, the reactor now meets the conditions for commercial operation. Initial fuel loading for the VVER-440 PWR occurred in September 2022, and grid connection occurred in January 2023.

Mochovce 3 has a capacity of 471 MWe, which meets almost 13% of electricity demand in Slovakia. The accompanying Mochovce 4 unit is reportedly about one year behind Unit

3's schedule. "With the completion of the commissioning of Unit 3, we have welcomed a new unit to our nuclear fleet," said Mochovce NPP director Martin Mráz. "The plant successfully passed demanding tests, including disconnection from the power grid at full power. This means that Unit 3 will be able to cope with such challenging situations."

## Westinghouse signs MOUs with Bulgaria to support new build efforts

On October 19, Westinghouse Electric Co. announced it signed Memorandums of Understanding (MOUs) with key Bulgarian suppliers to support the upcoming AP1000 nuclear new build project at the Kozloduy nuclear power plant in northern Bulgaria, and other projects throughout the region. The agreements outline the potential for manufacturing of key components, including instrumentation and controls (I&C) systems, radiation monitoring systems, as well as providing various engineering, consulting, and construction services. The suppliers include OSKAR-EL, Glavbolgarstroy, ENPRO Consult, EnergoService, and EQE Bulgaria.

"We continue to make excellent progress on the front-end engineering and design study for up to two AP1000 reactors at the Kozloduy site," said Westinghouse President of Energy Systems David Durham. "The Bulgarian nuclear supply chain is deeply experienced and will be critical in supporting our successful delivery of the world's most advanced, proven AP1000 reactor for our customer."

Westinghouse signed a Front-End Engineering and Design (FEED) contract with Bulgaria's Kozloduy NPP-Newbuild in June that focuses on deploying a new Westinghouse AP1000 PWR at the existing Kozloduy nuclear power plant site. Work is commencing per the agreement to assess Bulgaria's current industry and the existing infrastructure at the Kozloduy site for its potential to support the construction of an AP1000 reactor. There are currently two Russian-designed VVER-1000 PWRs in operation at the Units 5 & 6 of the Kozloduy nuclear power plant site in Bulgaria. In December 2022, Westinghouse signed a 10-year agreement to supply nuclear fuel to one of the units starting in 2024. The fuel under this agreement will be supplied out of Westinghouse's fabrication site in Västerås, Sweden.

## Eskom expects Koeberg 1 to return to commercial operation by mid-November

In a press release issued on October 20, South African utility Eskom announced that it successfully replaced the steam generators for Unit 1 at the Koeberg nuclear power plant located on South Africa's west coast. The company expects the 970 MWe PWR to begin supplying electricity to the grid by the end of the month. Power levels will gradually increase until the reactor attains its full capacity, which is anticipated two weeks after grid connection.

Eskom has delayed a planned upgrade program at Koeberg 2 that includes steam generator maintenance until after Unit 1

returns to commercial operation to ensure that at least one reactor is in operation. Although the outage for Unit 1 lasted almost a year, Eskom hopes it will be able to incorporate lessons learned to reduce the length of the maintenance program for Unit 2.

Replacement of steam generators for both reactors at Koeberg is a key part of lifespan extension for the two 970 MWe PWRs at Koeberg 1 & 2. The Koeberg nuclear power plant first started operation in 1984, and a planned 20-year lifespan extension would allow its two units to operate until 2044.

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### **EIA: U.S. nuclear power plant outages climb during summer 2023**

On October 17, the U.S. Energy Information Administration (EIA) announced that outages of U.S. nuclear generating capacity averaged 3.1 GWe per day during from June 1 through August 31. The EIA's latest report reflects U.S. nuclear power plant outages returning to 2021 levels, as outages during the past summer exceeded those in summer 2022 by more than 25%. EIA attributed higher nuclear capacity outages, particularly during the month of June 2023, to the fact that some reactors were still offline for refueling and maintenance outages, which averaged 6.1 GWe per day and peaked at 8.3 GWe during the month of June.

Through October 3, U.S. nuclear plant refueling outages in 2023 have averaged 35 days compared with 38 days during 2022. Several reactors began refueling and maintenance outages in April and May and were offline for an average of 34 days. EIA notes that some units remained offline for longer than a average, including: Millstone NPP in Connecticut, which was offline for 89 days, and the Columbia NPP in Washington, which began a 44-day outage in early May. EIA noted that both outages lasted into June and increased the overall summer capacity outage duration.

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### **CBOC report finds Darlington SMRs create significant economic benefits for Canada**

On October 20, the Conference Board of Canada (CBOC) published a report that analyzes the positive economic impacts stemming from Ontario Power Generation's (OPG) plans to build four GE-Hitachi BWRX-300 SMRs at the Darlington SMR Demonstration Project in southern Ontario, Canada. The report estimates that building and operating a fleet of four 300 MWe BWRX-300 units at the Darlington site will contribute approximately C\$15.3 billion to Canada's GDP, including C\$13.7 billion to Ontario's GDP. The SMR development program also looks to create and sustain 2,000 jobs each year in Canada over the next 65 years, in addition to generating more than C\$4.9 billion in tax revenues to municipal, provincial, and federal governments over a 65-year period. According to CBOC, the Province of Ontario is projected to reap 89% of the economic benefit associated with the SMR new build project.

OPG and its project partners are targeting construction

completion of the first Darlington SMR in 2028, with a view to begin supplying power to Ontario's grid in 2029. OPG is planning to bring the remaining three SMR units online in the mid-2030s, and looks to benefit from construction lessons learned incorporated into each unit constructed. "Being the first North American mover of this innovative technology positions Ontario as a world leader in nuclear and a welcoming destination for new business," said OPG President and CEO Ken Hartwick. "Our plan to construct four new reactors at Darlington will also generate opportunities across Ontario and Canada as suppliers of nuclear components and services have an opportunity to expand to serve the growing SMR market here and abroad."

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### **Newcleo inks MOU with Nuclear AMRC**

On October 18, SAMR developer Newcleo reported it signed a Memorandum of Understanding (MOU) with UK government-backed innovation center, Nuclear AMRC. The agreement outlines a collaborative partnership to advance manufacturability, supply chain, and development studies for new nuclear technology, including Newcleo's Lead Fast Reactor (LFR) design. The MOU also establishes a partnership for exploring a range of technical and business operations, including supply chain readiness assessments, investigation into potential supply chain partners, identification of entities for potential acquisition, modularization studies, manufacturability and fabrication assessments, material and metallurgy studies, and any other future areas of interest that are in the scope of agreement between the two parties.

Newcleo is working to deliver the design, licensing, and construction of its 30 MWe Mini LFR in France by 2030, followed by a 200 MWe commercial Small LFR unit in the UK by 2032. The company also has plans to accelerate its growth plans through prototype development, manufacturing plant set up, and site identification and acquisition costs in both France and the UK. The company announced plans to invest €3 billion in France by 2030 to build the Mini LFR design.

Newcleo Chairman and CEO Stefano Buono commented, "This partnership provides support to the development of our end-to-end industrialization strategy, as well as our business activities in the UK. This will play a helpful role in our mission of building a new competitive industrial standard in nuclear energy and providing safe solutions to energy and environmental challenges."

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## **Policy & Regulation**

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### **EC clears Westinghouse acquisition by Cameco and Brookfield**

The European Commission (EC) announced on October 17 that it has approved, under the European Union Merger Regulation, the acquisition of joint control of Westinghouse Electric Co. (WEC) by Brookfield Renewable Partners and Cameco Corp. The EC concluded that the proposed transaction "would not raise competition concerns, given its limited

impact on competition in the markets where the companies are active.”

The EC examined the acquisition under the normal merger review procedure. The examination stems from Cameco and Brookfield’s strategic partnership to acquire WEC in a deal valued at roughly \$7.9 billion. Upon conclusion of the deal, Brookfield Renewable will own a 51% interest in WEC with Cameco owning the remaining 49% interest. The agreement is slated to close later this year, once all relevant national regulatory reviews are expected to be completed.

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## EU forges compromise on electricity market reforms

On October 17, after months of on-again, off-again negotiations, European Union Energy Ministers came to a provisional agreement aimed at reforming the bloc’s electricity market. The move ends a multi-month bottleneck that hinged on France and Germany’s concessions allowed for nuclear energy. The two nations’ central disagreement centered on the use of state-backed schemes that allow governments to recoup profits from energy producers during price spikes under a Contracts for Difference (CfDs) scheme. Germany upheld negotiations over the CfDs, claiming that France could leverage its large nuclear power fleet under the program to gain an unfair competitive advantage through CfDs.

However, in a compromise agreement, EU Energy Ministers conferred that governments may apply CfDs to investments aimed at extending the lifespans of existing power plants. However, to appease Germany, CfDs will be subject to specific “design rules” established by the European Commission (EC) to prevent market distortion. The compromise followed a recent meeting between French President Emmanuel Macron and German Chancellor Olaf Scholz, with each leader seeking to resolve their energy policy differences. The compromise proposal now moves into negotiations with the European Parliament, which has already established its own compromise position.

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## China’s MEE accepts EIA documents for Haiyang 5 & 6 in Shandong Province

On October 17, China’s Ministry of Ecology and Environment (MEE) accepted the Environmental Impact Assessment (EIA) documents covering the siting stage for the Haiyang 5 & 6 new build project in Shandong Province, China. The EIA notes that Haiyang 5 & 6 will deploy CAP-1000 PWRs, which is an adapted version of Westinghouse’s AP1000. According to the EIA document, the construction period of each unit at Haiyang 5 & 6 is 56 months. Unit 5 is planned to begin construction in the first half of 2024 with the start of operations expected in the second half of 2028. Unit 6 is planned to start construction 10 months after Unit 5. Currently there are two AP1000 reactors operating at Haiyang 1 & 2 and two CAP-1000s under construction at Haiyang 3 & 4.

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## Taiwan’s Democratic Progressive Party presidential candidate willing to consider nuclear

According to recent news reports, the ruling candidate for Taiwan’s Democratic Progressive Party, Lai Ching-te, has stated that, if elected, he would consider the use of nuclear power provided that all safety issues including nuclear waste disposal are addressed. However, Lai remains opposed to extending lifespans for existing nuclear power plants or activating the two unit, mothballed Lungmen nuclear power plant. Taiwan’s current president Tsai Ing-wen, who is also a member of the Democratic Progressive Party but is term-limited and thus cannot run for re-election, aims to completely end the island’s use of nuclear by 2025. However, Lai, who currently serves as vice president, has called for continuing the energy policies of the current administration.

The two rival candidates for President of Taiwan, Hou Yui-h of the Kuomintang Party and Ko Wen-je of the People’s Party have both called for allowing the Lungmen plant to operate and extending lifespans for existing reactors. Taiwan’s presidential election is scheduled for January 13, 2024. Inauguration of the winning candidate will take place on May 20, 2024.

There are currently only two reactors in operation in Taiwan at the Maanshan nuclear power plant with scheduled closure dates in July 2024 and May 2025, when their respective 40-year operating licenses expire. Four more reactors at two nuclear power plant locations (Chinshan and Maanshan) were closed between December 2018 and March 2023. For many years, nuclear power supplied nearly 20% of Taiwan’s total electricity, but since the first reactor was permanently closed in 2018, nuclear power’s role on the island has gradually declined. During the first half of 2023, nuclear power provided less than 7% of Taiwan’s electricity in contrast to fossil fuels, which supplied more than 83% of the island’s electricity. To date, the share of renewables supplying power the island remains far from previous targets.

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## U.S. NRC amends nuclear liability insurance regulations

On October 19, the U.S. Nuclear Regulatory Commission (NRC) announced it is amending its regulations under 10 CFR Part 140 “Financial Protection Requirements and Indemnity Agreements,” which outlines the requirements and procedures for financial protections for operating nuclear power plants. The Commission notes that it plans to increase the required amount of primary nuclear liability insurance from \$450 million to \$500 million for each licensed operating reactor with a rated capacity of 100,000 electrical kilowatts or more. This change complies with the provision in the Price-Anderson Amendments Act of 1988 that states the amount of primary financial protection required of licensees by the NRC shall be the maximum amount available at reasonable cost and on reasonable terms from private sources. This final rule is being issued without prior public notice or opportunity for



public comments.

## Wolverine applies for federal funds to support Palisades PPA

It was reported on October 19 that Michigan electric cooperative Wolverine Power Supply submitted an application for funding through the U.S. Department of Agriculture's (DOA) New ERA \$9.7 billion grant and loan initiative that is funded by the Inflation Reduction Act. According to *Crains*, the DOA program rules could permit Wolverine to access up to \$970 million in federal funding, but the grant would only cover up to 25% of the total cost of the contract. If approved, the company plans to use the federal funds to offset its power purchase agreement (PPA) signed in September between Holtec Palisades Energy LLC and Wolverine to ensure operation of the Palisades nuclear power plant in Michigan.

The single-unit Palisades nuclear power plant was to be permanently shuttered in May 2022 when former owner, Entergy Corp., sold the plant to Holtec to perform decommissioning services. However, following acquisition and passage of federal and state government support measures in various legislation since 2021, Holtec has been working to obtain restart funding to get Palisades back online. The company signed a long-term, multi-decade PPA with Wolverine, which commits to purchase up to 67% of the carbon-free electricity generated from the single unit plant. The agreement between the companies also contains a contract expansion provision to include up to two SMRs that Holtec is considering building at the Palisades site.

## UK Parliament committee launches SMR investigation

On October 19, the UK Parliament's Environmental Audit Committee commenced an investigation to evaluate the use of SAMRs to allow the country to move away from the use of fossil fuels for electric power generation. The UK government expects that both large-scale reactors and SAMRs be part of a planned expansion in nuclear capacity of up to 24 GWe by 2050. Although the first SAMRs in the UK could be online in the 2030s, the government has not yet determined how their construction will be financed.

"As the UK moves away from fossil fuels towards low carbon alternatives, we must keep the lights on when the wind isn't blowing and the sun isn't shining. The Government has identified that nuclear power can help provide this baseload energy for the UK," said Environmental Audit Committee Chairman, Philip Dunne. "But as we know, large scale nuclear projects are enormously costly and take a long time to construct. Small modular reactors have been identified as being cheaper and quicker to manufacture, and the Committee would like to identify the role that SMRs can feasibly play in the UK's energy mix. We invite anyone with knowledge of SMRs to contribute to our inquiry."

The committee is seeking written submissions by Novem-

ber 9 on various issues related to SAMR regulation and finance, delivery timeframes, and the deployment process. Issues the committee is considering includes factors that could prevent SAMRs from being built in the UK, the impact of the UK's current SAMR design competition, the possible benefits of choosing more than one SAMR design, and possible export opportunities.

## Canadian government extends additional support for ARC-100 at Point Lepreau NPP

On October 16, Canada's Minister of Energy and Natural Resources Jonathan Wilkinson announced key funding initiatives aimed at accelerating the phase-out of coal-fired generation in New Brunswick and Nova Scotia, Canada. The federal government, along with the provincial governments of New Brunswick and Nova Scotia, signed agreements that include the advancement of two tracks of collaborative works aimed at phasing out coal power in these provinces. While much of the agreement's associated funding centers on grid improvements and converting a coal plant to biomass, the federal government also issued an additional C\$7.0 million in funding to help support development of ARC Clean Technology's planned deployment of the first-ever ARC-100 SAMR at NB Power's Point Lepreau nuclear power plant in New Brunswick with construction slated to commence toward the end of this decade.

Discussing the prospects of deploying the ARC-100 SAMR at Point Lepreau, New Brunswick Premier Blaine Higgs commented, "It is important to realize that none of this will be possible without substantial federal funding, and I look forward to future commitment in that regard."

## Uranium & Fuel Cycle

### Orano's board authorizes 2.5 million SWU capacity expansion of GBII in France

On October 19, Orano's Board of Directors formally approved the investment decision to yield a 2.5 million SWU expansion of the Georges Besse II (GBII) enrichment plant located in Tricastin, France. The project is expected to cost €1.7 billion and will increase the facility's existing 7.5 million SWU capacity by more than 30% to a total of 10 million SWU.

Under the investment decision, Orano looks to build four additional operating modules that are identical to the 14 existing modules operating at GBII today. During the construction phase, the project will mobilize up to 1,000 people, with a large proportion of those involved being from companies based in the region. The additional capacity at GBII is expected to be phased in over several years with the first new production available beginning in 2028.

François Lurin, Senior Executive Vice President, Chemistry-Enrichment Activities commented, "This project is seeing the light of day thanks to the support of our customers and to



Georges Besse II  
Source: Orano

the technical and commercial teams from Orano which have been mobilized on the project since March 2022. With this extension to capacity, the uranium produced on the Orano Tricastin site will allow low-carbon energy to be supplied to the equivalent of 120 million households each year.” Lurin added that the support of the Japan-France Enrichment Investing consortium (JFEI) and South Korea’s KHNP are important shareholders in the Tricastin enrichment company SETH (Société d’Enrichissement du Tricastin Holding), which are critical to completing the expansion.

### Lightbridge commences CANDU fuel engineering study

On October 17, U.S. fuel technology company Lightbridge Corp. announced that it engaged Romania’s Institutul de Cercetări Nucleare Pitești, a subsidiary of Regia Autonoma Tehnologii pentru Energia Nucleară (RATEN ICN) to perform an engineering study to assess the compatibility and suitability of Lightbridge Fuel design for use in CANDU PHWRs. The assessment looks to cover key areas including mechanical design, neutronics analysis, and thermal and thermal-hydraulic evaluations, and seeks to feed into future economic evaluations and regulatory licensing works.

### BHP’s Olympic Dam uranium production shows marginal gain in recent quarter

In BHP’s operational review for the fiscal first quarter (Q1 2024) ended September 30, 2023, the company reported that uranium production from its Olympic Dam copper-uranium-gold mine in South Australia increased by 1% to 825 t U<sub>3</sub>O<sub>8</sub> (~1.82 million pounds U<sub>3</sub>O<sub>8</sub>) compared to 817 t U<sub>3</sub>O<sub>8</sub> (~1.80 million pounds U<sub>3</sub>O<sub>8</sub>) in the same period of 2022. Meanwhile, copper production from Olympic Dam totaled 74.4 kt in Q1 2024 compared to 49.7 kt in Q1 2023. Production guidance for copper remains unchanged at between 310 kt and 340 kt for FY 2024. Exploration drilling continued beneath the Olympic Dam ore body with eight active drill rigs and at Oak Dam with 10 operating drill rigs.

BHP sold 481 t U<sub>3</sub>O<sub>8</sub> (~1.06 million pounds U<sub>3</sub>O<sub>8</sub>) from Olympic Dam in fiscal Q1 2024, which was 77% higher than 272 t U<sub>3</sub>O<sub>8</sub> (~600,000 pounds U<sub>3</sub>O<sub>8</sub>) in fiscal Q1 2023.

### Ur-Energy provides Q3 operations update

On October 18, Ur-Energy Inc. provided an update on 2023 third quarter (Q3) production operations and ramp up activities at its Lost Creek ISR project in Wyoming, efforts to build its uranium sales contract book, and advances at its Shirley Basin ISR project in Wyoming. The company said ramp-up operations at Lost Creek continue to progress with two new header houses (HH) in production in Mine Unit 2 (MU2): HH 2-4 and, most recently, HH 2-5. During Q3, the company produced approximately 30,491 pounds U<sub>3</sub>O<sub>8</sub> from HH 2-4. The company plans to continue bringing header houses online through the remainder of 2023 and going forward based upon its production plans.

Ur-Energy noted that it has faced challenges in the restart of the Lost Creek project, with one of the more significant new challenges being the recruitment and retention of employees and contractors. While the company has hired nearly every operations position, it stated that the turnover rate has hampered efficient operations. Together with the record-setting winter of 2022-2023, the company said these labor-related issues have resulted in initial work being slowed at Lost Creek.

The Casper construction facility is now fully staffed and operating as planned to allow for the construction of header houses, including electrical and instrumentation work, prior to delivery to Lost Creek. HH 2-6 and 2-7 are nearing completion, and construction is beginning on HH 2-8.

In the area of supply chain disruption, the company said its advanced ordering and recycling of old equipment at Lost Creek have allowed it to largely overcome the issue with minimal delays. Ur-Energy believes many of the supply chain issues it is experiencing are also the result of labor issues.

During Q3, the company made its first delivery into term contracts, with 90,000 pounds U<sub>3</sub>O<sub>8</sub> delivered to a purchaser for proceeds of \$5.4 million. A second delivery of 90,000 pounds U<sub>3</sub>O<sub>8</sub> is scheduled for Q4 2023. The company’s deliveries in 2024 are projected at 570,000 pounds U<sub>3</sub>O<sub>8</sub>, with deliveries expected to be made into two of three previously announced sales agreements. Ur-Energy stated it is in advanced discussions with three companies in the global nuclear industry for additional sales commitments, and is optimistic that negotiations with all three purchasers will result in completing additional sales agreements during Q4 2023. The most significant of the three proposals calls for annual delivery of between 100,000 pounds U<sub>3</sub>O<sub>8</sub> and 350,000 pounds U<sub>3</sub>O<sub>8</sub> over a five-year period beginning in 2026. Ur-Energy noted that the agreement will include the option for the buyer to add up to three additional years of deliveries of 300,000 pounds U<sub>3</sub>O<sub>8</sub> beginning in 2031. Pricing is a combination of an escalated fixed price, which is well above anticipated all-in costs of production, and market-related pricing that is subject to an escalated floor and ceiling. Additionally, the purchase will have the option of a small flex to the annual delivery.

Given advanced negotiations with nuclear fuel purchasers

and the strengthening uranium market, Ur-Energy's Board has authorized management to proceed with additional tasks to advance its Shirley Basin ISR uranium project. The company is initiating procurement of long-lead items for the project and will advance other activities in the field, with the objective of shortening the time for construction and ramp up when the "go" decision is made by its Board for construction. The company estimates it will take up to 24 months to complete all procurement, development activities, and construction of the satellite facility and associated first mine unit to initiate production.

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### **Paladin Energy provides update on Langer Heinrich uranium project in Namibia**

In Paladin Energy's Quarterly Activities Report for the period ending September 30, 2023, the company stated that it continues to progress and execute activities focused on returning its Langer Heinrich mine in Namibia to production with the project approximately 80% complete. Commissioning has commenced and the project remains on track and budget for first production in Q1 2024.

Paladin held cash and cash equivalents of \$99.8 million at September 30, 2023, with no corporate debt. During the last quarter, Paladin sold 12,987,013 shares in Lotus Resources Ltd. for gross proceeds of \$1.95 million. The company's net cash expenditure last quarter was \$28.3 million.

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### **Paladin Energy's ownership interest in Michelin project increases from 75% to 100%**

Paladin Energy Ltd. announced October 18 that it now holds a 100% interest in the Michelin advanced exploration uranium project in Labrador, Canada. As a result of the funding and dilution provisions of the Michelin Joint Venture Agreement, the Michelin Nominees surrendered their 25% participating interest in the Michelin Joint Venture to Aurora Energy Ltd., a Paladin subsidiary. With the increase in Aurora's interest in the Michelin project from 75% to 100%, Paladin has commenced a workstream to determine the pathway forward for the project and anticipates providing an update on future activities in the first half of the next calendar quarter.

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### **Deep Yellow provides update on Tumas uranium project in Namibia**

In Deep Yellow Ltd.'s Quarterly Activities Report released on October 18, the company stated that due to the recent escalation in uranium prices, the Front End Engineering Design work for its Tumas uranium project which commenced last quarter, has been temporarily paused until the full positive implications, including the recent metallurgical testwork, are incorporated into the financial assessment of the project. Deep Yellow now anticipates that progression of the Tumas project will continue by moving directly into the detailed engineering phase of project execution.

Additionally, Paladin noted that informal evidence is indicating potentially material declining costs and supply chain

relief post release of the Tumas Definitive Feasibility Study (DFS) in January 2023. Given that CAPEX and OPEX was estimated during a high inflation period (Q4 2022), Ausenco Services Ltd. (the engineering service provider that undertook the DFS) is repricing these parameters and auditable results will be available in late November 2023. Paladin said this strategy still allows the company to maintain current guidance on project development, with a Final Investment Decision expected to be made in mid-2024 and commencement of production in mid-2026.

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### **Botswana regulators approve Lotus' buyout of A-Cap Energy**

On October 19, regulatory authorities in Botswana approved the acquisition of minerals exploration company A-Cap Energy by Lotus Resources Ltd. Botswana's Minister of Mines and Energy issued no objection to the proposed shareholding change of the Letlhakane mining and prospecting license. The country's Competitions and Consumer Authority also granted unconditional approval for the deal.

As per the scheme implementation deed (SID) announced this past July, Lotus will acquire 100% of A-Cap Energy. The swap ratio is one share of Lotus for every 3.54 shares of A-Cap, with each A-Cap share valued at A\$0.052. Upon the deal's completion, Lotus shareholders will own 79% of the merged company and A-Cap shareholders will own the remaining 21% stake. The new company will hold an estimated resource of 241.5 million pounds U<sub>3</sub>O<sub>8</sub> between Kayelekera in Tanzania and Letlhakane in Botswana.

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### **Peninsula Energy establishes Dagger uranium project in Wyoming**

Peninsula Energy Ltd. and its wholly owned subsidiary Strata Energy announced October 23 the establishment of a new uranium development project, the Dagger project, which hosts an initial inferred mineral resource estimate of 6.9 million pounds U<sub>3</sub>O<sub>8</sub> at 0.1037% U<sub>3</sub>O<sub>8</sub>. The mineral resource estimate is based solely on significant historical drilling information. The Dagger project consists of ~4,140 acres of mineral rights and lies approximately 20 kilometers northeast of the company's Lance ISR project in Wyoming. Mining at Dagger would likely be done by the ISR method as well.

Peninsula Managing Director and CEO Wayne Heili commented, "Importantly, Dagger is located only 20 km from our Lance Project facilities, which provides the company with an exciting opportunity to further increase the size and scale of our already sizeable Mineral Resource inventory."

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### **Aura Energy identifies new uranium exploration target to extend existing Tiris project resource**

Aura Energy Ltd. reported October 17 that it has acquired additional radiometric survey data, reviewed historical drilling results, and identified strong indications of mineralization extensions on Aura's existing tenements that could significantly expand Aura's current Tiris uranium project resource of 58.9

million pounds U<sub>3</sub>O<sub>8</sub> at 0.0236% U<sub>3</sub>O<sub>8</sub> in Mauritania. The company has signed contracts for an exploration program of 15,500 meters of air core drilling over approximately 78 square kilometers on existing tenements, aiming to significantly increase the inferred mineral resource at Tiris by extending the existing resource. The mobilization of the drilling contractor commenced on October 16, with the program commencing soon after. The exploration target range for Tiris East is between 8 million pounds U<sub>3</sub>O<sub>8</sub> to 32 million pounds U<sub>3</sub>O<sub>8</sub> at a grade range between 0.012% U<sub>3</sub>O<sub>8</sub> to 0.024% U<sub>3</sub>O<sub>8</sub>.

Aura Managing Director David Woodall commented, "Further resource expansion towards 100m lbs of U<sub>3</sub>O<sub>8</sub> progresses the project towards a global scale and reinforces the potential for Mauritania to be a material producer in the near term. The robust economics of our Tiris Uranium Project will be further enhanced by increasing our mineral resources and reserves. Due to the modular nature of the project, we see outstanding opportunities to grow the annual production capacity of the project to 3.5Mlb per annum, equivalent to the planned back-end plant capacity."

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### **DevEx reports further step-out drill results at Nabarlek North**

DevEx Resources Ltd. reported October 18 further uranium results from its expanded 2023 drilling campaign at its 100%-owned Nabarlek uranium project located in the Alligator Rivers Uranium Province (ARUP) in the Northern Territory of Australia. Step-out drilling at the Nabarlek North Prospect returned shallow intercepts, including 11.2 meters at 0.33% U<sub>3</sub>O<sub>8</sub> from 41.0 meters and 21.5 meters at 0.11% U<sub>3</sub>O<sub>8</sub> from 36.0 meters.

With two drill rigs on site, a reverse circulation (RC) rig and a diamond rig, DevEx plans to maintain the current drilling momentum in the month ahead. RC drilling will continue at Nabarlek North over the coming weeks, after which the RC rig will relocate to the U40 Prospect to in-fill recently announced uranium equivalent intercepts, together with further step-out drilling to the south.

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### **Anfield to acquire uranium claims in Utah**

Anfield Energy Inc. announced October 18 that it has entered into a definitive agreement with Nolan Holdings, Inc. to acquire a 100% interest in 175 federal unpatented uranium mining claims located in San Juan and Grand Counties in Utah. As consideration for the claims and associated data, Nolan Holdings will receive \$85,000 in cash and 15,000,000 common shares of Anfield.

Anfield CEO Corey Dias commented, "We are pleased to acquire these uranium claims as we believe that they are complementary to our existing portfolio holdings in Utah. They are in close proximity to Anfield Energy's Shootaring Canyon mill, which makes them ideally suited for future exploration and production. When combined with a favorable regulatory environment and low transportation costs, these claims are an ideal addition to Anfield's portfolio."

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### **Marvel Discovery spin-out Power One applies for listing on TSXV**

Marvel Discovery Corp. reported October 18 that Power One, formed by Marvel via a Plan of Arrangement in 2021 through the spin-out of Marvel's Wicheeda North and Serpent River properties, has applied for listing on the TSX Venture Exchange (TSXV). Power One's Serpent River project is located 15 kilometers east of Elliot Lake, Ontario. Limited drilling by Rio Algom in 1974 at Pecors East showed a non-NI 43-101 compliant resource of 20 million tonnes averaging 0.037% U<sub>3</sub>O<sub>8</sub>. The Wicheedsa property is ~80 kilometers northeast of the city of Prince George in British Columbia and is primarily being targeted for rare earth elements.

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### **ALX Resources announces flow-through private placement to raise up to C\$500,000**

ALX Resources Corp. announced October 17 a non-brokered private placement of flow-through (FT) units for gross proceeds of up to C\$500,000. Up to 14,285,714 FT units will be offered at a price of C\$0.035 per FT unit consisting of one flow-through common share and one non flow-through common share purchase warrant. One common share purchase warrant from the FT units will entitle the holder to purchase one non flow-through common share of the company at a price of C\$0.05 for a period expiring 24 months following the closing date of the offering, which is expected to occur on or before November 24, 2023. Proceeds from the sale of FT units will be used solely for exploration programs on the company's Quebec, Saskatchewan, Ontario, and Nova Scotia mineral exploration properties.

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### **Okapi Resources to change name to Global Uranium and Enrichment Limited**

Okapi Resources reported October 19 that it will be seeking shareholder approval at its upcoming Annual General Meeting (AGM) to change the company's name to Global Uranium and Enrichment Limited. The proposed new name reflects the company's current operations and strategy in developing a portfolio of advanced, high grade uranium assets in the U.S. and Canada, as well as its cornerstone position in Ubaryon, an Australian private company that is developing a uranium enrichment technology. Should shareholders approve the proposed name change on November 14, the company will trade under the ASX code "GUE".

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### **Cosa Resources to commence trading on TSX Venture Exchange**

Cosa Resources Corp. announced October 17 that it received approval from the TSX Venture Exchange (TSXV) to list its common shares on the TSXV. The shares commenced trading on the TSXV on October 18. The company's trading symbol "COSA" will remain unchanged. The company's shares will continue to be listed on the OTCQB Marketplace in the U.S. under the symbol "COSAF" and on the Frankfurt Stock Exchange under the symbol "SSKU".

# The Market

## Uranium Spot & Forward Market

After moderate spot activity resulted in a decline in spot prices in the first two weeks of October, last week witnessed another turn in market sentiment and prices. A total of seven spot U<sub>3</sub>O<sub>8</sub> transactions were confirmed last week involving 700,000 pounds U<sub>3</sub>O<sub>8</sub>, all with delivery in the prompt window (0-3 months), although some deals were for January 2024 delivery. Buying interest remained present all week, leading sellers to pull back as the week progressed, reversing the trend noted during the first two weeks of the month, when sellers often were seen hitting the bid.

The past week started Monday with a deal concluded at \$69.00, which was still generally in line with transactions booked for prompt delivery during the prior week. However, new buying interest resulted in slightly higher bids on Tuesday and the daily price indicator inched up to \$69.25 per pound. A late-day deal concluded on Tuesday at \$70.00, and additional movement in the bid level, and two transactions above the \$70 level on Wednesday resulted in the daily price increasing sharply to \$70.50. As additional buying interest emerged with multiple potential buyers, and few if any firm offers especially depending on delivery month and location, the daily price indicator increased another \$0.50 on Thursday to \$71.00 per pound and two transactions that called for delivery in early 2024 were reported reflecting continued pressure on the forward curve. On Friday, other buyers revealed additional interest and bids continued to firm up, but it took lifting the offer to facilitate the single deal reported on Friday with a transaction price of \$73.00, which was the level of the price indicator reported as of the 2:30 p.m. ET cut-off for that day.

As many are now in face-to-face meetings at the NEI International Uranium Fuel Seminar in Charlotte, N.C., the spot market has been quiet so far today (Monday). While no transactions were reported prior to today's cut-off time, bids and offers have remained firm. Based on transactional volume breakdowns by location for recent activity, as well as currently available bids and offers at all locations, the Ux U<sub>3</sub>O<sub>8</sub> Price increases to \$73.00 per pound, unchanged for the day, but up \$4.00 for the week. Based on the most competitive

## Market Highlights

- The spot market was quite active over the past week, with at least one deal concluded each day of the week.
- As interested buyers bid up the market, sellers backed up offers and the spot price increased over the week before jumping to the \$73 level at the close on Friday.
- While no new formal utility term demand involving any component was reported last week, off-market activity resulted in several spot conversion deals and another utility term U<sub>3</sub>O<sub>8</sub> contract award.

market information, prices for delivery within three months at Cameco, ConverDyn, and Orano have all increased this week to \$73.00 per pound.

## Uranium Term Market

Term activity has remained very active with multiple utilities out with both formal requests and in off-market discussions. While no new formal demand was reported over the past week, off-market negotiations resulted in another non-U.S. utility term U<sub>3</sub>O<sub>8</sub> contract award with delivery starting in 2026. Also active in the market is a non-U.S. utility that is awaiting offers based on its request for up to 6.6 million pounds U<sub>3</sub>O<sub>8</sub> with delivery split over two time periods spanning 2026 through 2030. Offers are due November 6. Another non-U.S. utility is seeking multiple fuel options that include up to 1.3 million pounds U<sub>3</sub>O<sub>8</sub> with delivery over the 2026-2032 period. A third non-U.S. utility is evaluating offers based on its request for almost four million pounds U<sub>3</sub>O<sub>8</sub> contained in components or EUP with delivery in 2024-2030. Another non-U.S. utility also has an active request for information preceding its upcoming term component/EUP RFP. In addition to these active utilities, a few others are preparing for market entry seeking mid- and longer-term delivery.

## Conversion Market

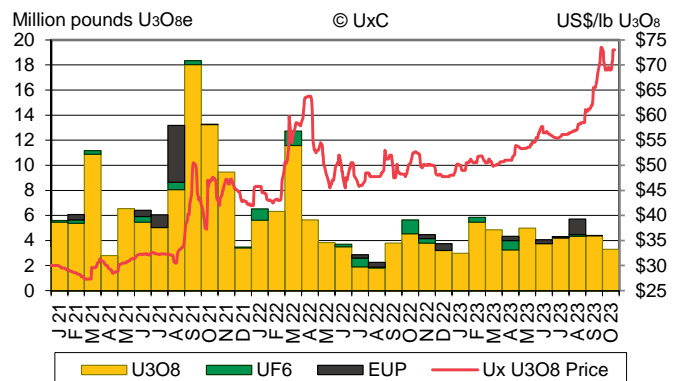
While activity in the spot conversion market has been limited in recent months, new off-market activity has been tracked over the past two weeks resulting in several spot transactions involving both conversion services and EUP. Beyond this activity, other demand interest remains active as a utility continues to seek some EUP material for near-term delivery as well as some additional off-market interest.

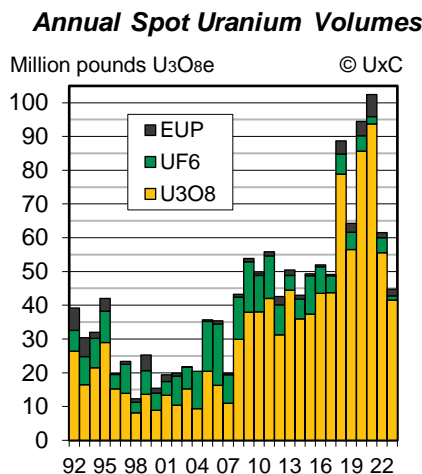
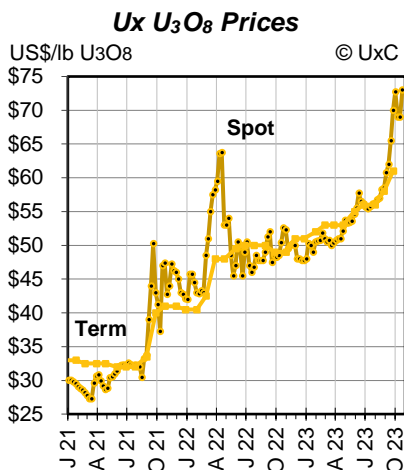
### UxC Market Statistics

Monthly (Oct)	Spot		Term (Utility only)	
	Volume	# Deals	Volume	# Deals
U <sub>3</sub> O <sub>8</sub> e (million lbs)	3.3	27	W	2
Conv. (thousand kgU)	W	W	0	0
SWU (thousand SWU)	W	W	0	0
2023 Y-T-D	Spot		Term (Utility only)	
	Volume	# Deals	Volume	# Deals
U <sub>3</sub> O <sub>8</sub> e (million lbs)	44.8	305	>145.0	42
Conv. (thousand kgU)	>2,000	23	36,709	25
SWU (thousand SWU)	>900	11	22,835	24

Key: N/A – Not available. W – Withheld due to client confidentiality.

### Ux U<sub>3</sub>O<sub>8</sub> Price vs. Spot Volume by Form





Ux Price Indicators (€ Equiv <sup>†</sup> )		
<b>Weekly (10/23/23)</b> 1 US\$ = .00000€		
<b>Ux U<sub>3</sub>O<sub>8</sub> Price</b>	<b>\$73.00</b>	€ .00
Ux U <sub>3</sub> O <sub>8</sub> CMC Price	\$73.00	€ .00
Ux U <sub>3</sub> O <sub>8</sub> CVD Price	\$73.00	€ .00
Ux U <sub>3</sub> O <sub>8</sub> ORO Price	\$73.00	€ .00
<b>Mth-End (9/25/23)</b> 1 US\$ = .94384€		
<b>U<sub>3</sub>O<sub>8</sub></b>	<b>Ux U<sub>3</sub>O<sub>8</sub> Price</b>	<b>\$70.00</b> €66.07
	CMC [Cameco]	\$70.00 €66.07
	CVD [ConverDyn]	\$70.00 €66.07
	ORO [Orano]	\$70.00 €66.07
	Spot MAP <sup>†</sup>	\$64.56 €60.93
	3-Yr Forward	\$75.00 €70.79
	5-Yr Forward	\$79.00 €74.56
	Long-Term	<b>\$61.00</b> €57.57
<b>Conversion</b>	NA Spot	<b>\$40.75</b> €38.46
	NA Term	<b>\$31.00</b> €29.26
	EU Spot	<b>\$40.75</b> €38.46
	EU Term	<b>\$31.00</b> €29.26
<b>Spot</b>	NA Price	<b>\$223.50</b> €210.95
	NA Value*	\$223.65 €211.08
	EU Value*	\$223.65 €211.08
<b>SWU</b>	Spot	<b>\$138.00</b> €130.25
	Long-Term	<b>\$148.00</b> €139.69
<b>EUP</b>	NA Spot**	\$3,145 €2,968
	NA Term**	\$2,868 €2,707

In the term conversion market, activity has been moderate over the past month, although no new formal demand was reported last week. However, a U.S. utility that entered the market seeking roughly 1.14 million kgU of conversion services for delivery in 2025-2028 and received offers last Monday (October 16) is now evaluating offers. Also still active is a non-U.S. utility awaiting offers based on its RFP for up to 3.9 million kgU as conversion services with delivery over the 2026-2032 period. Offers are due November 6. Another non-U.S. utility is seeking multiple fuel options that include up to 281,500 kgU of conversion or UF<sub>6</sub> with delivery over the 2029-2032 period. A third non-U.S. utility is evaluating offers for just over 1.5 million kgU of conversion services contained in EUP with delivery in 2024-2030. Another non-U.S. utility is pursuing a request for information for conversion services or conversion contained in EUP.

in a row that a small off-market EUP-related sale was confirmed. Other near-term demand interest remains as a non-U.S. utility is out for a small

amount of EUP for spot delivery and off-market interest also remain present. For term, a non-U.S. utility is believed to be finalizing its selection based on its request for EUP related to its SMR new build project with delivery starting in 2026. Another non-U.S. utility is seeking multiple fuel options involving up to a half million SWU with delivery over the 2027-2034 period. A third non-U.S. utility is out for just over 1.1 million SWU contained in EUP with delivery in 2024-2030. Another non-U.S. utility also has an active request for information supporting its upcoming term EUP request. Several other utilities remain active through various off-market activity.

### Enrichment & EUP Market

Although no new formal demand involving spot SWU or EUP was reported over the past week, this is the second week

### Ux Price Indicator Definitions

Ux Spot Prices indicate, subject to the terms listed, the most competitive offers available for the respective product or service of which UxC, LLC is aware, taking into consideration information on bid and transaction prices as well as the timing of bids, offers, and transactions (with a cut-off time of 2:30pm Eastern Time). The **Ux U<sub>3</sub>O<sub>8</sub> Price**<sup>®</sup> (Spot) includes conditions for delivery timeframe (≤ 3 months), quantity (≥ 100,000 pounds U<sub>3</sub>O<sub>8</sub>), and origin considerations. †The **Ux U<sub>3</sub>O<sub>8</sub> Monthly Average Price** (Spot MAP) represents the average of all Monday Ux U<sub>3</sub>O<sub>8</sub> Prices for the month. The **Ux U<sub>3</sub>O<sub>8</sub> 3-Year and 5-Year Forward Prices** reflect UxC's estimate of prices for U<sub>3</sub>O<sub>8</sub> delivery 36 and 60 months forward taking into account market activity and other indicators, using the same quantity and origin specifications as the Spot indicator. The **Ux LT U<sub>3</sub>O<sub>8</sub> Price** (Long-Term) includes conditions for escalation (from current quarter), delivery timeframe (≥ 36 months), and quantity flexibility (up to ±10%) considerations. The **Ux Conversion Prices** consider offers for delivery up to 12 months forward (Spot) and base-escalated long-term offers (Term) for multi-annual deliveries of conversion services with delivery in North America (NA) or Europe (EU). The **Ux NA UF<sub>6</sub> Price** includes conditions for delivery timeframe (6 months), quantity (≥ 50,000 kgU as UF<sub>6</sub>), and delivery considerations. \*The **Ux NA and EU UF<sub>6</sub> Values** represent the sum of the component U<sub>3</sub>O<sub>8</sub> (multiplied by 2.61285) and conversion spot prices as discussed above, and therefore do not necessarily represent the most competitive UF<sub>6</sub> spot offers available. The **Ux SWU Price** (Spot) considers spot offers for deliveries of SWU up to 12 months forward. The **Ux LT SWU Price** (Long-Term) reflects base-escalated long-term offers for multi-annual deliveries of SWU. \*\*The **Ux Spot and Term EUP Values** are provided for comparison purposes only and represent calculated prices per kgU of enriched uranium product based on a product assay of 4.50% and a tails assay of 0.30%, using spot and term Ux NA and appropriate spot and term price indicators. The Ux U<sub>3</sub>O<sub>8</sub> Price is published daily (excluding certain U.S. holidays), and all other Ux Price indicators are only published the last Monday of each month. All Ux Month-End Prices are as of the last Monday of each month. Ux Prices represent neither an offer to sell nor a bid to buy the products or services listed. †The Euro price equivalents are based on exchange rates sourced from XE.com at the time of publication and are for comparison purposes only. (Units – U<sub>3</sub>O<sub>8</sub>: US\$ per pound, Conversion/UF<sub>6</sub>: US\$ per kgU as UF<sub>6</sub>, SWU: US\$ per SWU, EUP: US\$ per kgU)

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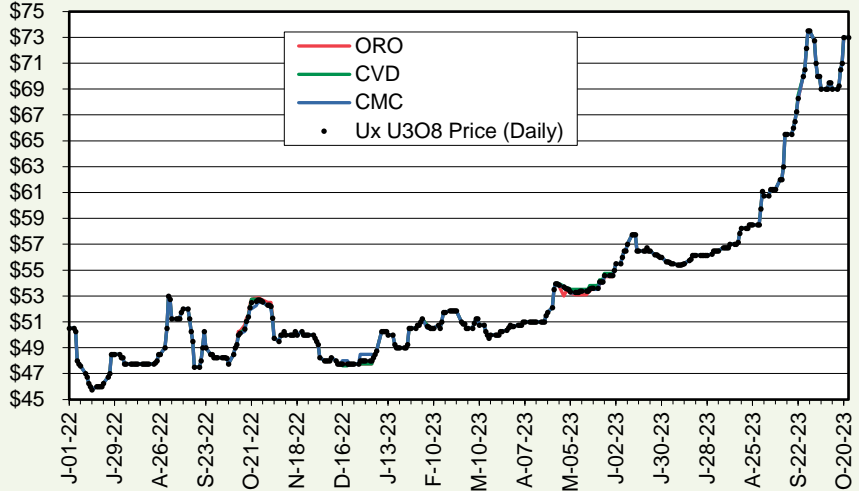
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### UxC U<sub>3</sub>O<sub>8</sub> Location Pricing

The spot Ux U<sub>3</sub>O<sub>8</sub> CMC, CVD, and ORO Prices reflect UxC's determination of prices for U<sub>3</sub>O<sub>8</sub> delivery at the specified delivery location taking into consideration bids, offers, and market activity, using the same delivery time period, quantity, and origin considerations as the Ux U<sub>3</sub>O<sub>8</sub> Price<sup>®</sup> indicator, and are published daily (excluding certain U.S. holidays). The CMC [Cameco], CVD [ConverDyn], and ORO [Orano] naming convention represent individual book transfer delivery locations. Please note that the use of company names as part of the delivery location naming convention represents neither an endorsement by the respective companies nor by UxC.

Under cooperation with our participating brokers, [Evo-lution Markets](#) and [Numerco Limited](#) (the "Brokers"), UxC collects on a daily basis the best spot bids and offers reported for prompt delivery. \*From this Broker data, UxC calculates the UxC Broker Average (BA) Bid and the UxC Broker Average (BA) Offer prices and presents them in the table below for comparison purposes only.

US\$/lb U<sub>3</sub>O<sub>8</sub>



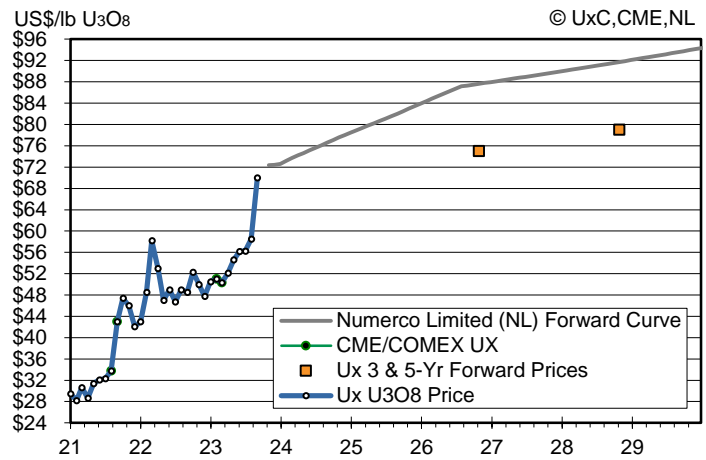
Daily UxC U<sub>3</sub>O<sub>8</sub> Spot Prices (Change from previous day)

Date	Ux U <sub>3</sub> O <sub>8</sub> Price	CMC [Cameco]	CVD [ConverDyn]	ORO [Orano]	UxC BA Bid*	UxC BA Offer*
23-Oct-23	\$73.00 (Unch.)	\$73.00 (Unch.)	\$73.00 (Unch.)	\$73.00 (Unch.)	\$72.25 (Unch.)	\$73.25 (Unch.)
20-Oct-23	\$73.00 (+2.00)	\$73.00 (+2.00)	\$73.00 (+2.00)	\$73.00 (+2.00)	\$72.25 (+1.50)	\$73.25 (+1.25)
19-Oct-23	\$71.00 (+0.50)	\$71.00 (+0.50)	\$71.00 (+0.50)	\$71.00 (+0.50)	\$70.75 (+1.00)	\$72.00 (+1.00)
18-Oct-23	\$70.50 (+1.25)	\$70.50 (+1.25)	\$70.50 (+1.25)	\$70.50 (+1.25)	\$69.75 (+0.63)	\$71.00 (+0.88)
17-Oct-23	\$69.25 (+0.25)	\$69.25 (+0.25)	\$69.25 (+0.25)	\$69.25 (+0.25)	\$69.12 (+0.50)	\$70.12 (+0.87)
16-Oct-23	\$69.00 (Unch.)	\$69.00 (Unch.)	\$69.00 (Unch.)	\$69.00 (Unch.)	\$68.62 (-0.06)	\$69.25 (-0.45)
13-Oct-23	\$69.00 (-0.50)	\$69.00 (-0.50)	\$69.00 (-0.50)	\$69.00 (-0.50)	\$68.68 (-0.07)	\$69.70 (-0.42)
12-Oct-23	\$69.50 (Unch.)	\$69.50 (Unch.)	\$69.50 (Unch.)	\$69.50 (Unch.)	\$68.75 (Unch.)	\$70.12 (Unch.)
11-Oct-23	\$69.50 (+0.50)	\$69.50 (+0.50)	\$69.50 (+0.50)	\$69.50 (+0.50)	\$68.75 (+0.13)	\$70.12 (+0.12)
10-Oct-23	\$69.00 (Unch.)	\$69.00 (Unch.)	\$69.00 (Unch.)	\$69.00 (Unch.)	\$68.62 (Unch.)	\$70.00 (+0.12)
09-Oct-23	\$69.00 (Unch.)	\$69.00 (Unch.)	\$69.00 (Unch.)	\$69.00 (Unch.)	\$68.62 (-0.13)	\$69.88 (Unch.)

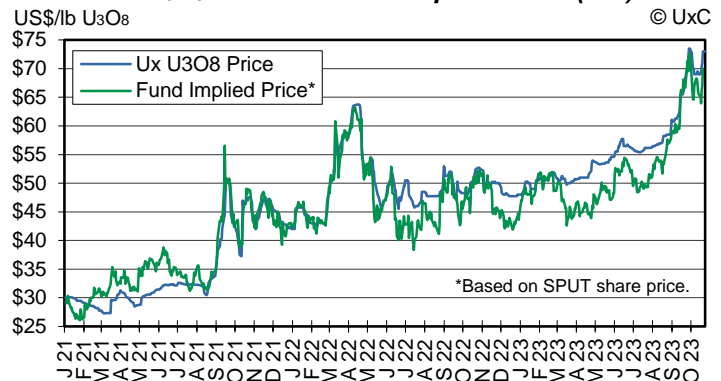
### Spot Volume by Delivery Month (Vol., # Deals)

Mth /Yr	All Transactions (U <sub>3</sub> O <sub>8</sub> e)						U <sub>3</sub> O <sub>8</sub> Only			
	0-3 Mos.		4-6 Mos.		7-12 Mos.		0-3 Mos.		>3 Mos.	
	Vol.	#	Vol.	#	Vol.	#	Vol.	#	Vol.	#
M 22	9.5	76	2.8	12	0.4	2	9.2	73	2.4	11
A	3.8	34	0.2	2	1.7	6	3.8	34	1.9	8
M	3.4	21	0.0	0	0.4	3	3.4	21	0.4	3
J	3.4	32	0.0	0	0.3	2	3.4	32	0.1	1
J	2.7	19	0.0	0	0.2	1	1.7	17	0.2	1
A	1.8	14	0.2	1	0.2	2	1.4	12	0.4	3
S	1.9	12	1.9	10	0.0	0	1.9	12	1.9	10
O	4.4	43	0.2	2	1.1	2	4.2	42	0.3	2
N	3.5	17	0.7	3	0.3	1	3.5	16	0.4	2
D	2.2	12	0.8	2	0.7	2	2.2	12	1.0	3
J 23	2.4	17	0.0	0	0.6	3	2.4	17	0.6	3
F	3.7	29	1.9	5	0.3	2	3.3	27	2.2	7
M	4.1	38	0.0	0	0.8	6	4.1	38	0.8	6
A	3.2	21	0.9	4	0.2	1	2.9	20	0.4	3
M	1.9	16	0.3	2	2.7	7	1.9	16	3.0	9
J	2.7	21	1.4	10	0.0	0	2.3	20	1.4	10
J	1.8	16	2.6	12	0.0	0	1.6	15	2.6	12
A	3.8	35	1.9	4	0.0	0	3.6	34	0.7	3
S	2.2	22	0.7	6	1.5	1	2.2	20	2.2	7
O	3.3	27	0.0	0	0.0	0	3.3	27	0.0	0

### Ux U<sub>3</sub>O<sub>8</sub> Price vs. CME UX Price vs. NL Forward Curve



### Ux U<sub>3</sub>O<sub>8</sub> Price vs. Fund Implied Price (FIP)



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\*Based on SPUT share price.