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UxC Interview with Mr. Tim Gitzel, President and CEO of Cameco Corporation

UxC President, Jonathan Hinze, recently had the opportunity to interview Mr. Tim Gitzel, President and Chief Executive Officer (CEO) of Cameco Corporation. Mr. Gitzel graciously shared with UxC the latest status and plans of his company and his views on the global nuclear markets.

Jonathan Hinze: Thank you very much for the opportunity to discuss Cameco's current situation and your views about the future of your company and the nuclear industry. Can you please provide us a brief history of your years at the helm of Cameco and what have been some of the biggest changes at Cameco over this time?

Tim Gitzel:

It is a pleasure to speak with you Jonathan. As you know, I took over as President and CEO in July 2011, just four months after the Fukushima disaster. It



hasn't been an easy run since then for any of us in the nuclear industry. At Cameco, we had to adjust our strategy from one of growth to one focused on tier one uranium and fuel service assets while maintaining a strong balance sheet and protecting and extending the value of both our asset base and of our contract portfolio. I am happy to say that the result has been resilient performance in today's difficult market. We think this puts us in the best position to capture the opportunities of tomorrow's improved market. After all, just like Three Mile Island and Chernobyl, we are seeing the fears of Fukushima giving way to the facts of climate change, clean air and the crucial role of nuclear power in ensuring safe, reliable and affordable zero-carbon electricity.

Hinze: The nuclear energy market is constantly evolving. Certainly the 2011 Fukushima accident continues to have impacts being felt today, but there are also many other important developments, both positive and negative, shaping the market. In your view, what is the current state of global nuclear power and where do you see it heading in the next decade or so?

Ux Price Indicators					
Weekly Ux U₃O₈ Price[®] (9/2/19)		\$25.30 (Unch.)			
Ux 3-Yr U ₃ O ₈ Price \$28.25		Ux 5-Yr U ₃ O ₈ Price \$32.00			
Month-end (8/26/19) *Calculated values					
U ₃ O ₈	Spot	\$25.30	Conversion	NA Spot	\$20.00
	Spot MAP*	\$25.26		NA Term	\$16.50
	3-Yr Forward	\$28.25		EU Spot	\$19.75
	5-Yr Forward	\$32.00		EU Term	\$16.50
	Long-Term	\$32.00			
UF ₆ Spot	NA Price	\$86.00	SWU	Spot	\$45.00
	NA Value*	\$86.11		Long-Term	\$47.00
	EU Value*	\$85.86		EUP	
				NA Spot*	\$1,160
				NA Term*	\$1,316

Gitzel: You know, I started in this business in 1979 when I was 17 years old. So, after 40 years, not sure I would use the term evolving. Instead, I think the market is repeating a familiar cycle. Consider first demand. Nuclear falls out of favour and countries abandon new build plans. Electricity is still required and the power largely comes from coal (and other fossil fuels). After some years, concerns about the carbon addiction and its impact upon climate and air quality mount. Nuclear power's role in ensuring safe, reliable and affordable zero-carbon electricity is recognized and demand begins to grow. Yet, during the demand sag, volume strategies and a lack of value discipline by many suppliers results in excess supply. Mines are depleted and sometimes exhausted. Surplus disposal and panicked selling in the spot market pushes prices down. De-linked from the actual production cost curve, the price is set by the most desperate seller, and it falls to levels that destroy supply as investments in growth and sustaining capacity are shelved, and, finally, production is curtailed and idled. With distressed supply in the market, complacency sets in despite the fact that this one-time, finite supply has replaced productive capacity.

Obviously, while the rhythm is familiar there are many specific amplifying factors. Today, two important and interrelated ones are the role of commercial and state-owned entities in the industry and the profound geographical disconnect between the supply of and demand for uranium. Together, these factors raise important national security concerns, they provoke trade policy distortions potentially regionalizing supply

and, ultimately, along with low prices they make the availability of future supply even less certain and predictable.

We have seen this before. The good news is that the pot hole of lost demand since 2011 has been filled and there are more than 50 reactors under construction. We see policy initiatives in many countries supporting nuclear power. A vibrant and growing nuclear fleet means, for us, customers who are confident in their future requirements resulting in increased contracting and the prices transitioning up to the actual production cost curve.

I truly believe that nuclear power is emerging from another down cycle and is poised to take its place in a world that needs safe, reliable and affordable zero-emissions electricity.

Hinze: Cameco has been a leading uranium and conversion supplier to the global nuclear fuel markets for many decades. How do you see your company's position in the market currently and what are you doing to maintain Cameco's leadership position for well into the future?

Gitzel: Cameco will continue to be the leading uranium and conversion supplier to the global nuclear fuel market because we honour our commitments and we do what we say we will do. Our competitive advantage begins with our outstanding employees who work every day to deliver value from our world-class, long-life uranium and fuel service operations. As the leading commercial supplier, we are not state-owned, and can be solely focused on helping our customers achieve the diversification needed in their fuel supply. But not just the classic cost and security of supply diversification. We are seeing increasingly stringent environmental, social and governance (ESG) performance standards upon the nuclear industry. As the ESG requirements grow, so will Cameco's competitive advantage as supplier of choice well into the future because not many suppliers can check all of these boxes. This is why we were able to successfully conclude 25 million pounds of new long-term business in early 2019 with more to come. Since this type of contracting has typically been a leading indicator, we are confident that a market transition has begun. I believe it will be an incumbent's recovery with customers focused on suppliers with a proven operating track record and tier-one production either idle or producing less than capacity. As such, we will be able to layer in new contracts that are acceptable to us while meeting the cost – security – ESG requirements of the nuclear industry.

Hinze: I imagine the decision to indefinitely suspend production at the McArthur River mine and Key Lake mill was a very difficult one. I also understand that Cameco has taken several other tough steps to reduce costs, including hundreds of layoffs, in light of the ongoing low uranium price environment. How have these moves changed the way Cameco operates, and what do you think will be the longer term effects of these decisions?

Gitzel: While we will always honour our commitments to our customers, our decision on sourcing our committed supply will always be value based, not volume based. We have

cut production well below our committed sales and are purchasing material to fulfill our commitments, backed up by a strong balance sheet that ensures we can self-manage risk while executing this approach. This is what separates commercial suppliers from non-commercial suppliers. Production curtailment decisions are among the most difficult decisions I have ever had to make. And, unfortunately, I have had to make a number of them. But without direct or indirect state-backing, we must make these decisions along with marketing and financial decisions that insulate us from contributing to today's near-term oversupply and that prevent us from having to chase this market down. Also, we preserve the value of one of the world's very best mining assets for the future giving our customers the confidence in our long-term, tier one supply base.

Going forward, there are a number of principles that you can expect us to follow. First, we will not produce from our tier-one assets to sell into an oversupplied spot market. Instead, this material is for acceptable term contracts. Second, we do not intend to build up an inventory of excess uranium because it contributes to a sense that uranium is abundant, and it just ties up our balance sheet. Third, along with meeting our current commitments, we will capture additional utility demand in the market where we think we can add value for ourselves and our customers and this may include spot, mid-term as well as long-term demand. Our contracting decisions always factor in price along with who the customer is, our desire for regional diversification, product form and logistical factors. Finally, once we capture that demand, we will decide how best to source it from production, inventory and our purchases.

These moves have changed us. We are a different company today. We are smaller and we have consolidated at our head office. This translates into a more efficient, more flexible and more nimble Cameco.

Hinze: As you probably are aware, the entire uranium market is anxious to know Cameco's plans for a McArthur River/Key Lake restart and also your approach going forward to covering your contracted supply commitments through alternative means, such as spot purchases, while McArthur River remains idled. What more can you tell us about these plans beyond what you have already publicly stated in your financial filings and investor conference calls?

Gitzel: Make no mistake, McArthur River/Key Lake are coming back but only when the time is right. And, not just coming back at the 18 million pounds per year but potentially ramping up to 25 million pounds per year. They are coming back long before any capital needs to be put at risk licensing, permitting, developing and commissioning any green field development in our industry. In fact, until you see existing producers with committed sales portfolios propose growth capital at existing licensed facilities you can be confident that green field is not required at all.

In terms of timing, we have been very clear about the operational, marketing and financial aspects of our strategy, and what we need to see in order to ensure our tier-one productive capacity is available longer term. As long as prices are being set by surplus disposal in the spot market, our plan is to preserve our assets and purchase spot material to deliver into our committed sales portfolio where there is a permanent home. We will remain disciplined until we can secure new acceptable contracts reflecting a price linked to the actual production cost curve. The contracting success we have had so far this year, and the ongoing off-market conversations we are having, indicates that the transition is underway and that our discipline is being rewarded.

With respect to purchases, well, we have a lot to make. We have more purchasing ahead of us, than behind us. Our number one objective is to purchase as cheaply as possible because purchases are more expensive than production. We determine our purchase volume and timing based upon the underlying trend in the market because the spot price is unreliable due to uneven price reporting practices, the timeframe that determines spot and the judgement used in price reporting. Without a true spot price, what matters to us is the market sentiment. If the market appears deflationary (for example, due to distressed selling), the cheaper material is not today, it is tomorrow. We will wait. If the market appears inflationary (for example, due to active and fundamental demand) the cheaper material is today, not tomorrow. We will be very active securing material to place into our committed sales.

Hinze: I would like to ask specifically regarding the future of your Canadian mines. Given that McArthur River is lower cost than Cigar Lake, what is the rationale behind keeping Cigar Lake operating and not restarting McArthur River? Has Cameco and its joint venture partners considered restarting McArthur River and placing Cigar Lake on standby?

Gitzel: The cash costs at the two operations are actually very similar. At the time we decided to take productive capacity off the market, McArthur River and Key Lake (MR/KL) made sense for us for a number of reasons. We own a greater share of the mine and we control the mill. Our share of production corresponded closely with the excess inventory we needed to work down over the initial 10-month period. We have only one partner in that joint venture, and our partner agreed to the suspension of production at first 10-months and then for an indeterminate duration. Taking MR/KL off actually removes more productive capacity from the market than does Cigar Lake since MR/KL has licensed capacity that would allow it to expand up to 25 million pounds of annual production while Cigar Lake is licensed for 18 million pounds per year.

Any decision on production at Cigar Lake mine involves a broader joint venture. And, the ore is milled at Orano's JEB Mill, which is a joint venture of its own with different partners than the mine. As such, any decision must involve an alignment of commercial interests across two joint ventures

which would be more complicated. However, since phase one of Cigar Lake is exhausted in early 2029, it is not inconceivable that others might wish to delay this date.

Hinze: Looking out beyond 2030, how do you foresee the uranium supply situation changing? What do you think has to occur in the market in the near- to medium-term to ensure the long-term sustainability of uranium supply? Do you agree with the view among some in the industry that uranium supply will always be plentiful, or do you think utilities should be concerned about surety of supply over the long-term?

Gitzel: It is no secret that today's prices are under pressure because of a lack of discipline in terms of some producing more than they should and some distressed sellers succumbing to various pressures and both selling into a discretionary market. Yet, this is neither fundamental nor sustainable. It is indeed unfortunate that a thinly traded spot market is distracting many from the underlying fact that the demand cycle has swung up while the production cycle has swung down.

There are many great assets that have sustainable, long-term supply. But, clearly, more will be needed once tier-one assets are producing at capacity. Complacency today about future supply that is based upon the exuberant promises of untested, unproven, unlicensed and unpermitted new production will simply result in a supply crisis when those promises are not fulfilled rather than an orderly transition to a price linked to the actual production cost curve. And, if trade policies create market access distortions, the shortfall could be pronounced for some markets. Moreover, it would not take much of an unplanned supply disruption to expose the dependency of today's market upon finite, non-productive capacity. We have all seen this happen before. As in the past, our customers can be confident that Cameco will deliver on supply commitments.

Hinze: The conversion market has seen dramatic price increases and diminishing supplies, especially following Honeywell's decision to take the Metropolis plant offline in late 2017. I understand that Cameco has increased UF₆ production significantly at your Port Hope plant. What can you tell utility customers to reassure them about your conversion operations and how Cameco plans to deal with these new conversion market conditions going forward?

Gitzel: Jonathan, I think every supplier, customer, investor and reporter should be paying real close attention to what has happened to the conversion market because while the market is different, I believe it is somewhat analogous to the uranium market. Just a few short years ago, too much capacity combined with too much secondary, one-time and finite supply resulted in an absurdly low conversion price. A price that was set by surplus disposal, de-linked from the actual production cost curve. Production curtailments began and then production challenges have been experienced in the industry. So what has happened? The price has rapidly increased over four-fold to a price linked to the actual production cost curve and, notably, the recent conversion price transition was not

anticipated by fuel cycle reporters. In other words, conversion has already gone through the transition that uranium is starting to go through, and, like conversion, fuel cycle reporting has clearly not yet recognized this transition and, once again, may only see it in the rear-view mirror.

In response to the increased customer demand our production has increased. The clear message is that if prices link to the actual production cost curve, then the market can be confident in a reliable supply from productive assets.

Hinze: Is there anything else that I have not asked that you would like to address? Also, what final message do you have for our readers regarding Cameco and the nuclear market in general?

Gitzel: Nuclear power plays a crucial role in ensuring safe, reliable and affordable zero-carbon electricity. As populations grow and so do electricity needs, the demand for uranium will grow. Cameco has a unique position as the largest commercial supplier of uranium and fuel services to run nuclear reactors around the world. We have taken the necessary actions to ensure that our future remains secure and we are well-positioned for the market transition.

Hinze: Tim, thank you again for agreeing to this interview and taking the time to provide thorough responses to my questions. On behalf of our Ux Weekly readers, I am certain that everyone in the global nuclear market has found your insights to be extremely valuable and enlightening.

News Briefs

KHNP announces commercial operation of Shin Kori 4

On September 2, Korea Hydro & Nuclear Power (KHNP) reported that company President Chung Jae-hoon and other company officials held a ceremony to mark the official start of commercial operation at Unit 4 of the Shin Kori nuclear power plant in South Korea. Shin Kori 4 is a domestically designed APR-1400 reactor with a total capacity of 1,350 MWe. The new reactor achieved initial criticality and was connected to the grid in April 2019. KHNP also operates another APR-1400 at the same site, Shin Kori 3, which commenced commercial operation in late 2016. With the addition of Shin Kori 4, South Korea now has a total of 24 operating reactors for a combined net generating capacity of 23.3 GWe.

KHNP receives U.S. NRC design certification for APR-1400

Korea Hydro & Nuclear Power (KHNP) reported August 27 that the U.S. Nuclear Regulatory Commission (NRC) certified KHNP/Korea Electric Power Corp.'s (KEPCO) Advanced Power Reactor 1400 (APR-1400), finding that the design adheres to U.S. safety requirements. NRC Commissioner Annie Caputo presented KHNP President Chung Jae-hoon with the design certificate for the APR-1400 at the NRC's headquarters in Washington, DC. The certificate is

valid for 15 years and can be extended for a further 15 years.

KEPCO/KHNP originally submitted the APR-1400 design review application in December 2014. The now-approved PWR design becomes the first non-U.S. reactor design certified by the U.S. NRC. The reactor produces approximately 1,400 MWe and features enhanced systems to safely shut down the reactor or mitigate the effects of an accident. The design won European design certification in October 2018.

Santee Cooper negotiating with South Korean company to restart VC Summer 2 & 3 project

Santee Cooper CEO Mark Bonsall told *The State* on August 28 that the state-owned South Carolina utility is currently in talks with "a party from the outside" that is looking to complete the now-abandoned Units 2 & 3 at the VC Summer nuclear power plant expansion. However, Bonsall added that Santee Cooper will not invest more money or assume any more risk if the project is restarted. "We are not basing (Santee Cooper's) new business plan on the assumption that that goes forward," said Bonsall regarding the likelihood that the two units are completed.

While Bonsall declined to name the companies involved in the discussions, he noted, "They're huge (companies). They're national. ... They're very real people. They're experienced. So for them, it is feasible." *The State* reported that at least one of the companies looking to revive the VC Summer expansion program is Korea Electric Power Co. (KEPCO). SC Senator Larry Grooms told the press that two of the three companies in the consortium that is evaluating the nuclear project are from South Korea, and the third company is a U.S.-based firm.

Santee Cooper and then-majority owner SCE&G began construction on VC Summer 2 & 3 in 2012. However, the units fell behind schedule and over budget due to construction management issues encountered by prime contractor and reactor vendor Westinghouse Electric. That vendor later filed for bankruptcy and SCE&G canceled the project in July 2017. The U.S. Nuclear Regulatory Commission (NRC) terminated the Summer 2 & 3 Combined Construction and Operating Licenses (COLs) in March 2019.

HB 6 petition passes Ohio Attorney General's office; pro-nuclear advocate joins the fight

On August 29, Ohio Attorney General Dave Yost approved Ohioans Against Corporate Bailouts (OACB) ballot summary language, which seeks to put the recently passed House Bill 6 (HB 6) to a public referendum in November 2020. Yost's approval now moves on to Ohio Secretary of State Frank LaRose to check if the initial batch of 1,000 signatures collected from registered voters favoring the referendum are valid. If Rose approves the signatures, OACB will be allowed to start collecting the 265,774 petition signatures from Ohio registered voters required by October 21, 2019, to test HB 6 on the November 2020 ballot.

In related news, a newly formed pro-nuclear advocacy group has joined the fight to keep HB 6 off the 2020 ballot. Ohioans for Energy Security spokesperson Carlo LoParo said the new group opposes any efforts to overturn HB 6 and is working to keep Ohioans from signing the referendum petition. “House Bill 6 is very important to Ohio’s energy economy and it’s very important to Ohio’s energy grid. What it does is it protects 4,000 Ohio energy jobs, protects Ohio’s primary source of clean energy generation, our two nuclear plants. And it ensures the integrity and security of our energy grid,” LoParo told the *Ohio Statehouse News Bureau*.

HB 6 has proven to be quite contentious since it was signed into law on July 23 (*UxW33-30*). The legislation provides up to \$150 million per year to support Ohio’s two operating nuclear power plants at Davis-Besse and Perry, both operated by FirstEnergy Solutions (FES). The company previously stated that it would close the two plants if it did not receive state support to keep them economically viable.

Rosatom completes testing Novovoronezh II-2 at 100% capacity

On September 2, Rosatom reported that it successfully completed testing at 100% capacity for Unit 2 of the Novovoronezh II nuclear power plant in Russia. The testwork program consisted of over 100 different tests and allows the VVER-1200 reactor to move on to final acceptance testing at rated power for 15 days. Novovoronezh II-2 Deputy Chief Engineer Vladimir Kazansky said that in the coming days, “All technological systems, instrumentation, interlocks, alarm and remote-control devices, protection, automatic regulators, and an automated process control system will be put into operation. These are the last tests of the unit before commissioning.”

Novovoronezh II Unit 2 is the country’s third VVER-1200 to be completed, following the launch of Unit 1 at the Novovoronezh II plant in 2016 and Unit 1 at Leningrad II in 2017. The reactor is expected to commence commercial operation by the end of 2019.

India in talks with Russia for additional six reactors

Financial Express reported August 28 that India and Russia are expected to formally clinch a deal in September for an additional six reactors to be supplied by Russia. Russian Minister Counselor and Deputy Chief of Trade Mission Roman Babushkin told the press, “The two countries are planning to ink a general contract for the construction of at least six extra power units...based on Russian design.” Babushkin said the proposed sites for the six additional reactors “are under consideration and the announcement will be made by the government of India.”

In July, it was reported that India’s Department of Atomic Energy (DAE) concluded talks with the Andhra Pradesh state government about the possibility of selecting a coastal site in the state for the construction of a nuclear power plant that will

host two Russian VVER-1200 reactors. Prime Minister’s Office official Jitendra Singh told the country’s parliament that DAE and Nuclear Power Corporation of India Ltd. (NPCIL) concluded discussions with Andhra Pradesh’s government to identify a second coastal site to build the two units, but he did not disclose the exact site proposed.

CNNC installs Karachi 2 pump motor

China National Nuclear Corp. (CNNC) reported August 26 that the first reactor coolant pump motor was installed in Unit 2 of the Karachi nuclear power plant in Pakistan. Karachi 2 is the first overseas demonstration project of the domestically developed HPR-1000 (Hualong One) reactor. The successful installation is expected to facilitate follow-up cold tests for the nuclear power project, said CNNC representatives.

CNNC is working to bring Karachi 2 online in 2021. A second HPR-1000 reactor under construction at the site – Karachi 3 – is scheduled to start up in 2022. CNNC is responsible for delivering Karachi 2 & 3 on a lump-sum turnkey basis.

Japanese consortium signs agreement for BWR collaboration

On August 28, Tokyo Electric Power Co. Holdings Inc. (TEPCO), Chubu Electric Power Co., Hitachi Ltd., and Toshiba Corp. announced a basic agreement to discuss potential collaboration for nuclear energy business focused on boiling water reactors (BWRs). The consortium reported that it exchanged opinions and information on topics, such as increasing the sophistication of nuclear power plant operation and maintenance, and bolstering manufacturing and engineering capabilities, with an aim to improve safety and economic viability, and enhancing the companies’ business structures. The basic agreement was signed following exchanges of opinions and based on a consensus view to advance discussions for cooperation between the four companies, “with the aim of creating sustainable business operations for safe and economical operation of the BWR business, and constructing and operating nuclear power plants.”

The companies added that they look to use their collective knowledge and insight of the BWR market and leverage this experience into improved safety and economic viability while building a sustainable business framework for maintaining and developing human resources, technologies, and supply chains.

AEC whitepaper advises Japan’s nuclear sector to prepare for decommissioning era

Japan’s Atomic Energy Commission (AEC) released a whitepaper on September 2 stating that the country is now entering an era of extensive nuclear plant decommissioning, and thus nuclear plant operators should begin planning now to lower safety costs and risks that will require billions of dollars and decades of work to complete. “Taking into consideration further increase of nuclear facilities that will be decommissioned, new technology and systems need to be developed in

order to carry out the tasks efficiently and smoothly,” said the report. “It’s a whole new stage that we have to proceed to and tackle.”

Since the Fukushima Daiichi accident in March 2011, only nine reactors in Japan have been restarted for approximately 3% of the country’s total electricity supply. The current Japanese government energy policy expects the country to receive approximately 20-22% of its total energy supply from nuclear power by 2030 – a goal that many consider overly ambitious and unrealistic as 24 of the 54 total reactors operating before Fukushima have announced decommissioning plans or are currently undergoing decommissioning. Furthermore, despite the lofty government nuclear power targets, reactor restarts are progressing slower than anticipated as the Nuclear Regulation Authority (NRA) spends a considerable amount of time on each plant inspection. It was reported at the end of August (*UxW33-34*) that none of the six reactors cleared for restart by the NRA will resume operation in 2019 due to delayed safety measures and local opposition. Furthermore, possibly all of the nine reactors restarted to date are likely to shut down again (some as early as the first half of 2020) as they have been unable to comply within the five-year deadline for NRA-mandated anti-terrorism regulations.

The AEC annual whitepaper also stresses that Japan’s utilities should begin working to learn from U.S. and European companies that have already successfully decommissioned nuclear power plants to bolster the country’s knowhow for decommissioning its own reactors. To date, Japan has neither completed decommissioning of any of its reactors nor has any plans for final disposal of radioactive waste. Finally, the white paper stressed that the country should work to reduce its plutonium stockpile, estimated at 47 tons, while simultaneously increasing transparency over its plutonium supply.

France’s CEA scraps ASTRID SFR project

It was reported August 30 that France’s Atomic Energy Commission (CEA) will halt efforts to develop the Advanced Sodium Technological Reactor for Industrial Demonstration (ASTRID) project. The CEA told *Le Monde*, “In the current energy market situation, the perspective of industrial development of fourth-generation reactors is not planned before the second half of this century.” Following decades of research and hundreds of millions of euros in development costs, the CEA stated in November 2018 that it was weighing the option of reducing ASTRID’s total capacity to under 200 MWe from the initially planned 600 MWe. A CEA source told *Le Monde* that the ASTRID project is all but “dead” and that the agency is no longer interested in spending any further time or financial resources on the project.

ASTRID was a fourth-generation sodium-cooled fast breeder reactor (SFR) proposed by CEA sited for the existing Marcoule nuclear site in southern France. The project was designed to preserve uranium resources by facilitating the multi-recycling of plutonium. A commercial fleet of 1,500 MWe SFRs based on ASTRID was to be deployed post-2050.

Energoatom and Turboatom ink five-year NPP modernization deal

Kyiv Post reported August 27 that Ukraine’s nuclear operator, Energoatom, signed a five-year contract, covering the period from 2020-2024, with JSC Turboatom to modernize equipment of the country’s nuclear power plants. Energoatom said the program entails the replacement of eight turbine condensers at several Ukrainian nuclear reactors, including four Russian-made condensers. The contract also calls for a turbine cylinder modernization project including five turbines with a 1,000 MWe capacity. The turbine cylinder modernization program includes the replacement of rotor blades on existing rotors and diaphragms to increase the turbine’s power and efficiency.

“Four years ago, we gave a new powerful start to our cooperation, which is not only servicing the turbine park, but also the replacement and modernization of equipment. This will allow us to increase and improve the efficiency of nuclear power plants, to increase the generation of electric energy, which is important in conditions a new market, when every additional kilowatt-hour produced gives additional income,” said Energoatom President Yuriy Nedashkovsky to *Interfax-Ukraine*.

TVEL delivers first batch of MOX fuel to Beloyarsk

TVEL reported August 27 that it delivered the first batch of uranium-plutonium MOX fuel for the Beloyarsk nuclear power plant in Zelenogorsk. The company delivered 18 fuel assemblies to the BN-800 Beloyarsk fast neutron reactor scheduled for loading in the fourth quarter of 2019. After loading the first 18 MOX assemblies in Unit 4 of the Beloyarsk nuclear power plant, the reactor will operate with a hybrid core containing both uranium fuel and uranium-plutonium MOX fuel.

“Further deliveries will ultimately allow the formation of an active zone with a full load of uranium-plutonium fuel and for the first time in the history of Russian nuclear energy to ensure the operation of a ‘fast’ MOX fuel reactor. This will be the final stage of many years of work, for the sake of which the BN-800 reactor was created, a power unit was built, a unique fuel fabrication production was organized,” said TVEL Vice President for Technology Development and Creation of Closed Nuclear Fuel Cycle Production Facilities Vitaly Khadeev.

KNF signs nuclear fuel MOU with Dominion Engineering

KEPCO-subsiary Korea Nuclear Fuel (KNF) signed a Memorandum of Understanding (MOU) with Dominion Engineering Inc. (DEI) of the U.S. on August 30 for business cooperation regarding nuclear fuel services needed for overseas nuclear power plants. Since 2005, KEPCO has been working to develop nuclear fuel cleaning equipment to remove

“CRUD” – a term for corrosion particles that become radioactive – in nuclear power plants throughout South Korea. Clad cleaning is a technology that uses ultrasonic waves to separate corrosion products (crudes) deposited on burning nuclear power fuels, which not only increases the efficiency of nuclear power plants but also reduces the radiation dose in the reactor system, thereby improving the safety of power plants.

KNF said KEPCO plans to expand its presence in the overseas nuclear fuel services market through this agreement. President Sang-Bong Chung said, “Signing a business agreement with DEI is an important opportunity to expand our business area. I will actively promote it.”

Federal council aims for Switzerland to be climate-neutral by 2050

Based on new scientific findings published by the Intergovernmental Panel on Climate Change, the Swiss Federal Council decided at a meeting on August 28 to set an even more ambitious climate goal, as Switzerland now plans to reduce its net carbon emissions to zero by 2050, thus meeting the internationally agreed target of limiting global warming to a maximum of 1.5°C when compared with the pre-industrial era. While the 2050 climate strategy did not mention nuclear’s role in meeting these ambitious carbon abatement targets, the strategy stated, “...CO₂ emissions from transport, buildings and industry can be reduced by up to 95 per cent by 2050 through technologies that are already available and by using renewable energy sources.” Presumably, “technologies that are already available” means continued operations of the country’s nuclear power plants where permitted.

California lawmaker seeks to reclassify nuclear in an effort to keep Diablo Canyon open

California Assemblyman Jordan Cunningham has introduced a proposed amendment to the state’s constitution that would classify nuclear power as a renewable resource. Cunningham stated that nuclear power needs to be included as a renewable resource in order to help meet the state’s goals to reduce greenhouse gas emissions. “Basic principals of fairness demand that we count all carbon-free power – including nuclear and large hydro – towards our climate goals,” said Cunningham to the *Santa Maria Times*. “Furthermore, it will be extremely difficult if not impossible, for the state to meet its 2030 and 2045 climate goals without counting nuclear and large hydro.”

Cunningham also said the amendment could allow the Diablo Canyon nuclear power plant, scheduled for closure in 2025, to remain operational until 2045. However, plant owner Pacific Gas and Electric stated that approval of the amendment would not impact its plans to shut the plant down. Also, he acknowledged that getting approval for his constitutional amendment would be a long shot given the need to secure approval by two-thirds of both houses of the state legislature and then a majority of voters in a public referendum,

WNA releases World Nuclear Performance Report

On August 29, the World Nuclear Association (WNA) issued the latest edition of the World Nuclear Performance report. The report stated that electricity generation from nuclear power attained 2,563 TWh in 2019, which represents its sixth consecutive year of growth. Last year, nuclear power provided approximately 10% of worldwide electricity generation, and the average capacity factor for reactors worldwide was 80%. In addition, nine new reactors began electricity generation including seven units in China and two in Russia, and seven units were permanently shut down. The combined capacity of the new units that began operation was 10.4 GWe, while that of the reactors that closed was 5.4 GWe. According to the report, in 2018, average construction time for new reactor was eight-and-a-half years, a significant increase over the more typical five-to-six years.

The report concludes that use of new designs is the primary reason for prolonged construction and foresees a return to more normal construction durations in 2019. In remarks at in the report’s preface, WNA Director General Agneta Rising said a significant greater commitment is needed from policy makers to meet goals of expanding nuclear power to 25% of global electricity supply by 2050. “If we are to be serious about climate change we should also be serious about the solutions,” said Rising. “Transitioning to a low-carbon economy that meets the energy needs of the global community presents a daunting task. But it is a challenge that must be met, and one that can only be met by using the full potential of nuclear energy.”

Nuclear expert says large reactors not viable in Australia but still argues for lifting of ban

Businessman and nuclear expert Ziggy Switkowski, who led a previous investigation into the possible use of nuclear power in Australia, told the country’s parliament that he did not believe large capacity nuclear reactors would be suitable for use. “Given that the investment in a power station, particularly a big one, would begin at US\$10 billion and go up from there, and it would take about 15 years to make it work, you can’t progress without strong community support and bipartisanship at the federal level-and there is not too much evidence of that,” said Switkowski as quoted by *The Canberra Times*.

Additionally, he stated it will take about ten years to determine whether small modular reactors are a viable option for Australia given the amount of time needed to collect sufficient information to make a decision on the use of SMR technology and examine the various designs now under regulatory consideration abroad. However, Switkowski called for Australia’s ban on nuclear power to be lifted, and he sees small modular reactors as possible sources of electricity to support mining and desalination operations. “We really should not be making decisions in 2019 based on legislation passed in 1999 reflecting the views of 1979,” said Switkowski to *Brinkwire*.

Switkowski stated that the nation needs a coherent policy on energy for nuclear power to have a chance of succeeding.

Switkowski's comments came during a public hearing held August 29 by Parliament's Standing committee on Environment and Energy into the possible use of nuclear power in Australia that is now underway. The committee will continue to accept written submissions as part of its ongoing inquiry into the prospects for nuclear power in Australia until September 16. Findings from the committee's inquiry are due later this year.

Georgia Power says Vogtle 3 & 4 in-service dates remain unchanged in 20th CMR

On August 30, Georgia Power filed with the Georgia Public Service Commission (GAPSC) the 20th Semi-Annual Construction Monitoring Report (CMR) for Units 3 & 4 at the Vogtle nuclear power plant in Georgia for the reporting period of July 1, 2018 through June 30, 2019. Georgia Power said it has continued to monitor and evaluate costs associated with completion of the two-unit AP1000 expansion, finding that the company's projected share of the total cost remains at \$8.4 billion. Capital expenditures to date are \$5.19 billion after accounting for receipt of the Parent Guaranty from Toshiba and the Westinghouse settlement. The company estimated that the remaining capital spend to complete the project is \$2.8 billion, excluding contingencies.

Georgia Power confirmed with the GAPSC that the target in-service dates for the project remain unchanged at November 2021 for Unit 3 and November 2022 for Unit 4. However, the company continues targeting in-service dates "that are ahead of the regulatory-approved in-service dates for construction, testing, and startup activities."

Exelon explores nuclear-based hydrogen production

It was reported August 29 that Exelon Corp., the U.S.' largest power and nuclear power generator, and Norway's Nel Hydrogen are investigating how Nel Hydrogen could demonstrate an integrated hydrogen production, storage, and utilization facility at an existing nuclear power plant site. The project – in collaboration with several national laboratories, including Idaho National Laboratory, National Renewable Energy Laboratory, and Argonne National Laboratory – calls for Exelon to select a site to install a proton exchange membrane (PEM) electrolyzer plus a hydrogen storage system. *POWER* said that the nuclear plant will likely be in an organized power market to allow the co-production of hydrogen and power to bolster the selected reactor's economics.

Nel Hydrogen currently offers PEM electrolyzers for transport and renewable energy solutions. PEM uses anodes and cathodes separated by a thin ion-conducting electrolytic membrane. In the hydrogen production process, water reacts at the anode to form oxygen and positively charged hydrogen ions. Protons then traverse across the PEM to the cathode to combine with electrons to form the external circuit to form

hydrogen gas. Exelon Corporate Strategy Manager Dr. Uuganbayar Otgonbaatar told *POWER* that while PEM has been demonstrated commercially (~2 MW), "It has not been scaled up to this point." He stated that Exelon has already used a similar technology on a smaller scale at a fossil plant whereupon the hydrogen produced is used to cool the plant's turbine generator. The target size for the nuclear hydrogen project is 1 MWe. "You can think about the 1 MW as the installed capacity of the unit. Depending on how it's operated, the quantity of hydrogen generated from that unit will be different, and it will be operated in a way to match the demand of the power plant," he said.

If the hydrogen pilot is proven feasible at scale, Exelon says it could be used in several ways to bolster nuclear plant economics. In addition to onsite self-supply to aid in reducing operations and maintenance costs, the hydrogen could be sold for gas pipeline injection or into regional hydrogen markets for eventual use in industry. The project is one of 29 initiatives announced by the U.S. Department of Energy (DOE) in mid-August selected to receive up to \$40 million in Fiscal 2019 of federal funds to advance the H2@Scale concept. That concept looks to enable large-scale hydrogen generation, transport, storage, and utilization in the U.S. Exelon is now set to commence award negotiations with the DOE for approximately \$3.6 million in federal funding, which it will cost-share for the three-year demonstration program.

Rolls-Royce and AMS partner for advanced I&C

On August 28, Analysis and Measurement Services Corp. (AMS) and Rolls-Royce signed a partnership agreement to provide advanced instrumentation and control (I&C) system testing services to the global nuclear energy market. As part of the "PULSE" initiative developed by Rolls-Royce, range of services will be provided by the two companies aimed at monitoring the performance of safety I&C components, including neutron detectors, pressure transmitters, temperature probes, cables, and connections.

AMS President Dr. H.M. Hashemian said, "We are truly honored to partner with Rolls-Royce to bring our respective expertise, experience, and capabilities in the I&C field to support nuclear power plants operating worldwide. AMS has been in business for over 40 years serving all the nuclear power plants in the United States and many in Europe and Asia. AMS' partnership with Rolls-Royce will add a significant new dimension to AMS' worldwide footprint."

Kazatomprom reports H1 2019 results

On August 27, Kazatomprom (KAP) reported net profit through the first six months ended June 30, 2019 of KZT 104.0 billion (~US\$267.9 million) compared to KZT 326.4 billion (~US\$840.7 million) in the first half (H1) of 2018. A significant portion of the decline was associated with one-time effects of transactions in both years, particularly the inclusion of the JV Inkai LLP, Karatau LLP, JV Akbastau JSC in the consolidation in 2018 and JV Khorasan-U LLP in 2019.

Meanwhile, the company's operating profit for H1 2019 was KZT 27.1 billion (~US\$698 million), up 69% from KZT 16.0 billion (~US\$41.2 million) in H1 2018, mainly due to the weakening of the Kazakh tenge against the U.S. dollar and higher average sales price. Consolidated revenue for H1 2019 was KZT 176.6 billion (~US\$454.9 million), an increase of 22% compared to KZT 145.0 billion (~US\$373.5 million) in H1 2018, which was primarily due to an increase in the average sales price due to higher spot uranium prices and the weakening of the Kazakh tenge against the U.S. dollar. This was partially offset by lower sales volumes in 2019 compared to 2018. Cost of sales totaled KZT 129,596 million (~US\$333.8 million) in H1 2019, which was 15% higher than KZT 113,106 million (~US\$291.3 million) in H1 2018, mainly due to the change in the Group structure and the consequent recognition of acquired assets at fair values that led to higher depreciation and amortization of property, plant, and equipment.

Consolidated U₃O₈ sales were KZT 144.4 billion (~US\$371.9 million) in H1 2019, an increase of 29% compared to KZT 111.9 billion (~US\$288.2 million) in H1 2018, mainly due to an increase in the average sales price reflecting a higher spot uranium price and weakening of the Kazakh tenge against the U.S. dollar. Consolidated U₃O₈ sales volume totaled 5,425 tU (~14.1 million pounds U₃O₈) in H1 2019, which was 3% lower than consolidated sales of 5,579 tU (14.5 million pounds U₃O₈) in H1 2018. KAP sales volume (not including intercompany transactions between KAP HQ and THK) totaled 4,608 tU (~12.0 million pounds U₃O₈) in H1 2019 compared to 5,167 tU (~13.4 million pounds U₃O₈) in H1 2018. The average sales price realized by the Group in H1 2019 was KZT 26,620 per kgU (US\$26.99 per pound U₃O₈) compared to KZT 20,063 per kgU (US\$23.64) in H1 2018.

Production volume of U₃O₈ on a 100% basis for Kazakhstan amounted to 10,800 tU (~28.1 million pounds U₃O₈) in H1 2019 compared to 10,905 tU (~28.4 million pounds U₃O₈) in H1 2018. Kazakh production was lower based upon the production plans at various operations. Kazatomprom's attributable production totaled 6,226 tU (~16.2 million pounds U₃O₈) in H1 2019, up 8% from 5,771 tU (~15.0 million pounds U₃O₈) in H1 2018. Attributable cash cost (C1) equaled US\$9.86 per pound U₃O₈ in H1 2019, which was 19% lower than US\$12.20 per pound U₃O₈ in H1 2018. Meanwhile, attributable all-in sustaining cost (AISC) was US\$13.27 per pound U₃O₈ in H1 2019, compared to US\$16.28 per pound U₃O₈ in H1 2018. The decreases in C1 and AISC were primarily due to weakening of the Kazakh tenge against the U.S. dollar, the change in the Group structure, and continued cost optimization efforts.

Consolidated Group inventory of finished products amounted to 10,374 tU (~27.0 million pounds U₃O₈) at the end of H1 2019, which was 11% lower than 11,635 tU (~30.3 million pounds U₃O₈) at the end of H1 2018. KAP inventory

of finished goods totaled 8,407 tU (~21.9 million pounds U₃O₈) at the end of H1 2019, compared to 10,095 tU (~26.2 million pounds U₃O₈) at the end of H1 2018. KAP continues to target an ongoing inventory level of approximately six to seven months of annual attributable production.

Kazakh production expectations remain unchanged from previous guidance of 22,750-22,800 tU (59.2-59.3 million pounds U₃O₈) for 2019. KAP's attributable production is expected to total 13,000-13,500 tU (~33.8-35.1 million pounds U₃O₈) for 2019.

Denison reports ISR field testwork results at Wheeler River's Phoenix deposit

Denison Mines Corp. announced August 27 initial test results from Test Area 1, as part of the ongoing In-Situ Recovery (ISR) field test program at the Phoenix deposit of its 90% owned Wheeler River uranium project in the eastern Athabasca Basin. This work is designed to test the Phoenix orebody's ISR characteristics and to evaluate hydrologic conditions that can be used to assess the hydraulic connection and potential mining solution flow between a series of test wells.

The company noted that initial test results have confirmed hydraulic connectivity between the test wells in Test Area 1 of the Phoenix deposit. Denison added that information collected through this process is expected to increase overall confidence in the application of ISR mining at Phoenix and to facilitate detailed mine planning as part of the Feasibility Study (FS) process. As part of the test program, two pump/injection (P/I) wells and nine observation wells were installed within the Test Area 1 boundary at Phoenix Zone A. The remaining Test Areas (Test Area 3 and 4) are expected to be evaluated in future years to support the completion of a FS. The company concluded that the main objective within each Test Area is to efficiently establish the fundamental hydrogeologic characteristics of the orebody, the overlying sandstone and overburden formations, and the underlying basement rocks.

Denison President and CEO David Cates said, "We are very pleased with the initial results from Test Area 1 as part of the ongoing ISR field test program. The program is the first-of-its-kind for the Athabasca Basin – assessing the suitability of the ISR mining method to the unique Phoenix deposit. The initial results from Test Area 1 are quite encouraging – with initial pump and injection tests confirming hydraulic connectivity between all of the test wells within the ore zone. We are looking forward to further results from Test Area 1 and Test Area 2, as well as the results from two large-diameter commercial scale wells planned for these Test Areas later this summer."

IsoEnergy reports Hurricane Zone drill results

On August 28, IsoEnergy Ltd. announced an update to its recently completed summer drill program at the Hurricane Zone on the company's 100% owned Larocque East uranium property in the eastern Athabasca Basin. Highlights from assays received for drill hole LE19-18C1 consist of 1.2% U₃O₈

over 5.0 meters, including 3.9% U₃O₈ over 0.5 meters. The company noted that the summer drill program is now complete and geological interpretations will be finalized once all pending assays have been received. IsoEnergy added that the Hurricane Zone is to be the focus of future drilling activities, with work slated to commence in January 2020.

IsoEnergy was founded and supported by the team at its major shareholder, NexGen Energy Ltd.

UPC holds reverse auction for spot conversion; NAV update

On August 29, Uranium Participation Corp. (UPC) subsidiary, Uranium Participation Bermuda Ltd. (UPBL), announced in an emailed Request for Proposals (RFP) that the company holds an inventory of UF₆ conversion services that it is interested in selling via a reverse auction. UPC is looking to sell up to 300,000 kgU of conversion services for delivery between June 15, 2020 and September 15, 2020. UPBL will deliver UF₆ to the purchaser, and the purchaser will deliver an equivalent quantity of uranium concentrates (U₃O₈) to UPBL. Offers to purchase must be for a minimum of 100,000 kgU as UF₆ conversion services in 50,000-kgU increments. UF₆ will be delivered by book transfer at URENCO's UUSA facility in New Mexico and uranium concentrates are to be delivered by book transfer to UPC's account at Cameco's Blind River facility in Ontario. Offers are due by 5:00 PM Eastern Time on September 13, 2019 and the validity period extends through September 27, 2019. The uranium delivered is to be U.S.-legal and non-Russian origin.

In other news, UPC reported its latest Net Asset Value (NAV) on August 21 for the period ended July 31, 2019 showing C\$603.9 million or C\$4.37 per share. UPC's investment portfolio consisted of 14,159,354 pounds U₃O₈ at a fair value of C\$474,726,000 and 1,117,230 kgU as UF₆ carrying a fair value of C\$125,594,000.

Azarga's Dewey Burdock advances toward EPA permitting

On August 28, Azarga Uranium Corp. reported that it received notice that the U.S. Environmental Protection Agency (EPA) issued revised draft permits for the company's Dewey Burdock in-situ recovery (ISR) uranium project in South Dakota. The revised draft permits incorporate comments submitted to the EPA on the original draft permits, including comments submitted by the company. The revised draft EPA permits pertain to Azarga's planned Class III and Class V Underground Injection Control (UIC) activities.

The Class III and Class V UIC EPA permits represent one of the three major regulatory agency approvals required for the Dewey Burdock project. The EPA's

public notice shows that the draft permits will be made available for public comment until October 10, 2019. Azarga President and CEO Blake Steele said, "We are pleased that the revised draft EPA permits for the Company's flagship Dewey Burdock Project address the majority of the comments submitted by the Company. This is a significant step towards the issuance of the final EPA permits and continues to advance the Dewey Burdock Project towards development. The Company remains focused on working with the EPA to obtain the final permits in the near-term. In parallel with advancing our permitting initiatives, we expect to publish the results of an updated preliminary economic assessment in the fall of 2019 for the Dewey Burdock Project."

The company already holds the source and Byproduct Materials License from the U.S. Nuclear Regulatory Commission (NRC), which is another of the three major regulatory agency approvals required for the Dewey Burdock project. Azarga has the opportunity to resolve the only outstanding contention to its NRC license in Q4 2019. Furthermore, the company said that the South Dakota Department of Environment and Natural Resources staff has recommended approval of the major state permits. The hearings to finalize the state permitting process have been deferred until the federal permits, namely those pertaining to the NRC and EPA, are issued.

Peninsula reports low pH field demonstration and transition update

On September 2, Peninsula Energy Ltd. announced an update on the company's efforts to transition the Lance in-situ recovery (ISR) project in Wyoming to a low pH operation. The company has concluded the initial mining and restoration phases of the low pH field demonstration trial at Lance, in addition to finalizing the Interim Operation Report summarizing the field demonstration trial's results for eventual submission to the Wyoming Department of Environmental Quality (WDEQ). Peninsula said that commercial-scale low pH mining in Mine Units 1 & 2 can commence upon acceptance by the WDEQ that predefined criteria have been achieved. In the meantime, the company is working to optimize and de-risk the project with a view to complete this process in the first half of 2020.

Peninsula Managing Director/CEO Wayne Heili commented, "We are very pleased with the performance of both the mining and initial restoration activities of our low pH field demonstration. All the key performance objectives have been satisfied and this will guide our future planning and activities. These results, in combination with the recent completion of the major permit and license amendments, exemplify the results driven focus of the Peninsula team."

UxC Monthly Spot Market Data					
Month	Ux U3O8 Price	Volume (mill lbs U3O8e)	Average	# of Trans	
			Leadtime # of Months		
Sep '18	\$27.35	6.87	3.1	36	
Oct	\$27.90	7.62	3.9	49	
Nov	\$29.10	9.93	4.1	45	
Dec	\$28.50	2.32	1.0	19	
Jan '19	\$28.90	6.68	2.3	38	
Feb	\$28.00	4.87	3.2	18	
Mar	\$25.75	6.87	1.4	45	
Apr	\$25.25	4.09	3.7	18	
May	\$24.10	3.13	2.3	22	
Jun	\$24.70	2.91	2.5	17	
Jul	\$25.50	3.96	2.1	28	
Aug	\$25.30	3.23	2.6	11	

The Market

August Market Review

After the market patiently waited through mid-July for President Trump’s decision on the 232 investigation, the anticipated increase in market activity since then has yet to materialize. In fact, outside of a few larger than average spot deals, overall August volume would have been close to record lows. The number of transactions for the month declined to its lowest level in two years with only 13 spot deals reported. Of this total, ten were as U₃O₈, one was in the form of UF₆, two were for conversion services, and none involved enrichment. Of the uranium contained deals, there were 11 transactions involving 3.2 million pounds U₃O₈ equivalent, bringing this year’s totals to 35.7 million pounds U₃O₈e under 197 transactions. For term, there were four reported utility term contract awards, one for conversion services and the other three involving enrichment services. In addition, there were several non-utility mid-term uranium purchases.

Uranium Spot & Forward Market

With today being the Labor Day holiday in the U.S. and many traveling this week to London for the WNA Symposium, spot market activity has been quiet. A non-U.S. utility is awaiting offers due today (Monday) involving a reload of EUP (19 tU as EUP) with delivery in February 2020. Another non-U.S. utility is evaluating offers for 220 tU as U₃O₈ (about 572,000 pounds) with delivery in 2020. A third non-U.S. utility that received offers last week based on its second-round request for 257,000 kgU of UF₆ (about 672,000 pounds U₃O₈ equivalent) with delivery in October 2019 is nearing a selection. Several other utilities have also reportedly been interested in both spot and near-term delivery.

Based on recent activity as well as currently available bids and offers, the Ux U₃O₈ Price is unchanged for the week at \$25.30 per pound. The Ux 3-Year and 5-Year U₃O₈ Forward Prices are also unchanged at \$28.25 and \$32.00 per pound, respectively (see chart on page 13).

UxC Broker Average Price

The UxC Broker Average Price (BAP) began the week on Tuesday up \$0.03 to \$25.34. The midpoint held the \$25.34 level for only a day before sliding to finish the week on Friday at \$25.28, down \$0.03 on the day. Today’s UxC BAP is \$25.25, down \$0.03 from Friday and down \$0.06 from last Monday’s \$25.31. The BA Bid is \$25.10, down \$0.02 from last Monday’s \$25.12, and the BA Offer is \$25.40, down \$0.10 from last week’s \$25.50.

Fund Implied Price (FIP)

Fund Implied Prices (FIP) started the week on Tuesday down \$0.06 to \$24.37. The FIP experienced moderate price deterioration through the rest of the week, finishing slightly lower on Friday at \$24.15, down \$0.07 on the day. Today’s FIP is \$24.43 per pound, up \$0.28 from Friday and up \$0.06 from last Monday’s \$24.37.

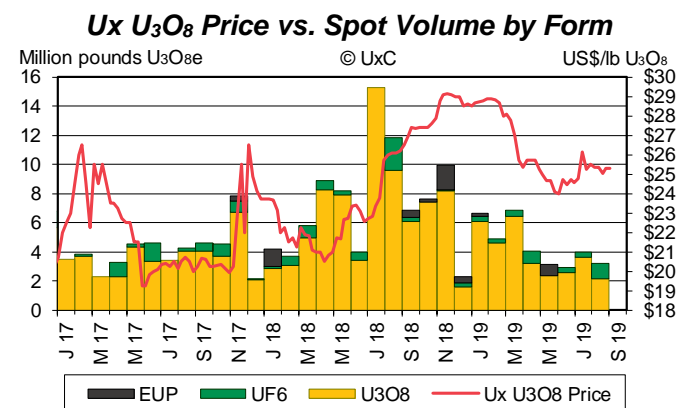
U₃O₈ Futures Market

The CME Group futures market for uranium once again was absent of any transactions during the last week of August. Pricing on the strip throughout the week was flat, only gaining an average of about \$0.03 by week’s end on Friday. There have been no contracts concluded in August. Therefore, the 2019 annum total remains unchanged from last week at 9,384 contracts (2,346,000 pounds U₃O₈). Total open interest also went unchanged during the week at 2,810 contracts (702,500 pounds U₃O₈).

UxC Market Statistics				
Monthly (Aug)	Spot		Term	
	Volume	# Deals	Volume	# Deals
U ₃ O ₈ e (million lbs)	3.2	11	0	0
Conv. (thousand kgU)	>850	4	W	1
SWU (thousand SWU)	0	0	W	3
2019 Y-T-D	Spot		Term	
	Volume	# Deals	Volume	# Deals
U ₃ O ₈ e (million lbs)	35.7	197	>40.0	20
Conv. (thousand kgU)	>3,700	28	>10,000	13
SWU (thousand SWU)	W	5	12,584	8

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

UxC Leading Price Indicators	
Three-month forward looking price indicators, with publication delayed one month. Readings as of August 2019.	
Uranium (Range: -17 to +17)	0 [unchanged]
Conversion (Range: -16 to +16)	+7 [up 1 point]
Enrichment (Range: -18 to +18)	+1 [unchanged]

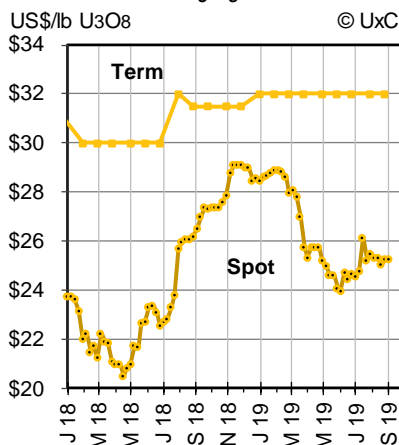


Non-Renewable Resource

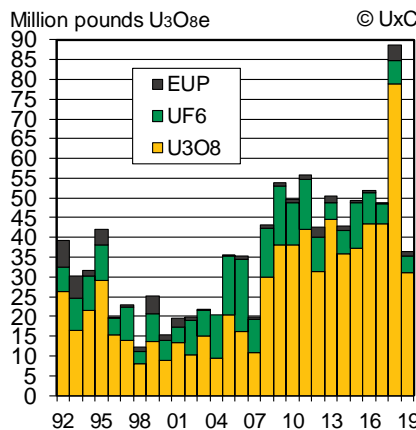
The congregation of a very old small stone church decided that the stone, which formed the step up to the front door, had become too worn by its years of use and would have to be replaced. Unfortunately, there were hardly any funds available for the replacement. Then someone came up with the bright idea that the replacement could be postponed for many years by simply turning the block of stone over.

They discovered that their great-grandparents had beaten them to it.

Ux U₃O₈ Prices



Annual Spot Uranium Volumes



Ux Price Indicators (€ Equiv[†])

Weekly (9/2/19)		1 US\$ = .91169€	
Ux U₃O₈ Price	\$25.30	€23.07	
Ux 3-Yr Forward	\$28.25	€25.76	
Ux 5-Yr Forward	\$32.00	€29.17	
Mth-end (8/26/19)		1 US\$ = .90088€	
U₃O₈	Spot	\$25.30	€22.79
	Spot MAP [†]	\$25.26	€22.76
	3-Yr Forward	\$28.25	€25.45
	5-Yr Forward	\$32.00	€28.83
	Long-Term	\$32.00	€28.83
Conversion	NA Spot	\$20.00	€18.02
	NA Term	\$16.50	€14.86
	EU Spot	\$19.75	€17.79
	EU Term	\$16.50	€14.86
UF₆ Spot	NA Price	\$86.00	€77.48
	NA Value [*]	\$86.11	€77.57
	EU Value [*]	\$85.86	€77.34
SWU	Spot	\$45.00	€40.54
	Long-Term	\$47.00	€42.34
EUP	NA Spot ^{**}	\$1,160	€1,045
	NA Term ^{**}	\$1,316	€1,186

Uranium Term Market

Term uranium activity was once again quiet with no new demand or contract awards reported. A U.S. utility that is reviewing offers based on its request for U₃O₈ with delivery over the 2021-2025 time period (totaling 1.2 million pounds U₃O₈, not including flex) plus options in 2026-2027 (adding an additional 600,000 pounds U₃O₈) is nearing its selection. A non-U.S. utility out for up to 55% of requirements with delivery over the 2022-2026 time period will request updated offers later this year. Another non-U.S. utility is reviewing budgetary offers prior to its formal request for just over 2.7 million pounds U₃O₈e as UF₆/EUP, including options, with delivery in 2022-2025. Several other utilities are either in quiet discussions or are preparing to enter the term market.

with delivery in 2020-2026. A non-U.S. utility out for EUP or components totaling up to 55% of its requirements with delivery in 2022-2026 will request updated offers later this year. Another non-U.S. utility is reviewing budgetary offers involving over one million kgU as UF₆ (including options).

Conversion & UF₆

Spot activity remains limited but a transaction for conversion services was concluded last week. A non-U.S. utility is also nearing selection for 257,000 kgU of UF₆ with October 2019 delivery. In addition, a financial entity is requesting bids to sell up to 300,000 kgU of conversion for delivery in 2020 (see page 10). For term, a U.S. utility is evaluating conversion services offers involving just over one million kgU

Enrichment & EUP

Although no transactions are reported, a non-U.S. utility is seeking spot offers due today (Monday) for 19 tonnes of EUP with February 2020 delivery. Another utility has spot offers due tomorrow (Tuesday) for 100,000 SWU. For term, as noted last week, a couple of utilities recently made selections. A non-U.S. utility will seek final offers in September for 55% of its SWU/EUP requirements with delivery in 2022-2026. Another non-U.S. utility is reviewing budgetary offers for up to 730,000 SWU with delivery in 2022-2025.

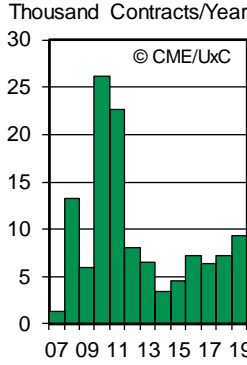
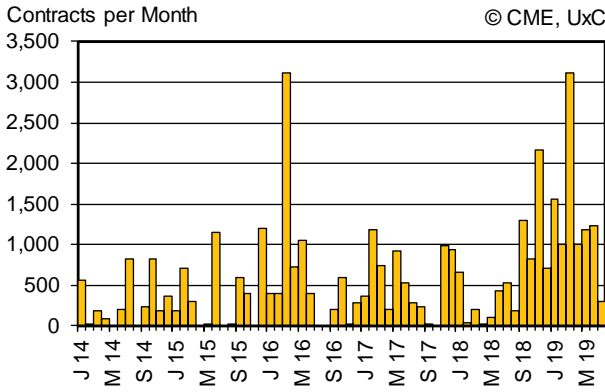
Ux Price Indicator Definitions

The Ux Spot Prices indicate, subject to the terms listed, the most competitive offers available for the respective product or service of which UxC, LLC (UxC) is aware, taking into consideration information on bid prices for these products and services and the timing of bids and offers as well (with a Monday cut-off time of 2:30pm Eastern Time). The Ux U₃O₈ Price[®] (Spot) includes conditions for delivery timeframe (≤ 3 months), quantity (≥ 100,000 pounds), and origin considerations, and is published weekly. [†]The Ux U₃O₈ Monthly Average Price (Spot MAP) represents the average of all weekly Ux U₃O₈ Prices for the month. The Ux 3-Year and 5-Year U₃O₈ Forward Prices reflect UxC's estimate of prices for U₃O₈ 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 U₃O₈ 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 twelve months forward (Spot) and base-escalated long-term offers (Term) for multi-annual deliveries with delivery in North America (NA) or Europe (EU). The Ux NA UF₆ Price includes conditions for delivery timeframe (6 months), quantity (50-150,000 kgU), and delivery considerations. ^{*}The Ux NA and EU UF₆ Values represent the sum of the component U₃O₈ (multiplied by 2.61285) and conversion spot prices as discussed above and, therefore, do not necessarily represent the most competitive UF₆ spot offers available. The Ux SWU Price (Spot) considers spot offers for deliveries up to twelve months forward. The Ux LT SWU Price (Long-Term) reflects base-escalated long-term offers for multi-annual deliveries. ^{**}The Ux Spot and Term EUP Values 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 and are provided for comparison purposes only. All prices, except for the weekly spot Ux U₃O₈ and Forward Prices, are published the last Monday of each month. The 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 rate estimates at the time of publication and are for comparison purposes only. (Units: U₃O₈ = US\$ per pound, Conversion/UF₆: US\$ per kgU, SWU: US\$ per SWU, EUP: US\$ per kgU)

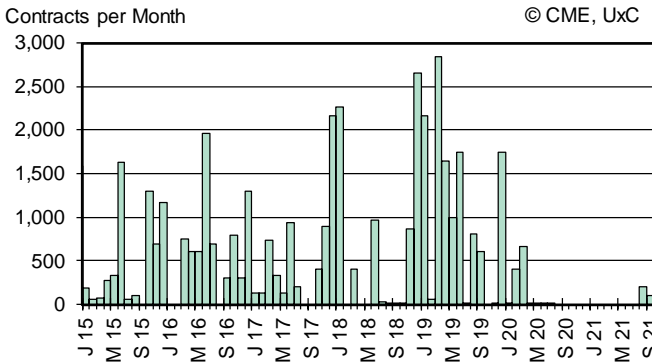
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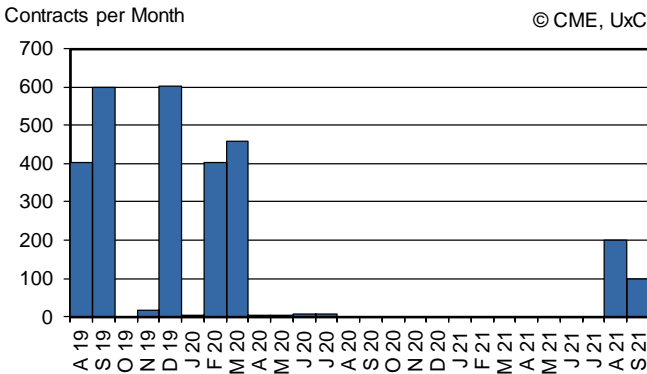
CME/NYMEX UX Futures Activity
Total Contracts by Transaction Month, by Transaction Year



Total Contracts by Settlement Month



Open Interest by Settlement Month

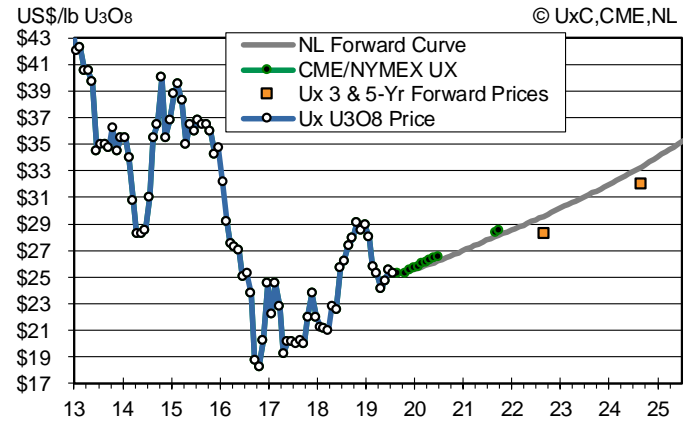


CME Uranium U₃O₈ (UX) Futures

Activity as of August 30, 2019

Settlement	Price	Volume	Open
Jun 2018	\$22.55	963	N/A
Jul 2018	\$25.70	25	N/A
Aug 2018	\$26.20	6	N/A
Sep 2018	\$27.30	12	N/A
Oct 2018	\$27.90	12	N/A
Nov 2018	\$29.10	874	N/A
Dec 2018	\$28.50	2,657	N/A
Jan 2019	\$28.90	2,168	N/A
Feb 2019	\$28.00	55	N/A
Mar 2019	\$25.75	2,845	N/A
Apr 2019	\$25.25	1,646	N/A
May 2019	\$24.10	1,000	N/A
Jun 2019	\$24.70	1,752	N/A
Jul 2019	\$25.50	14	N/A
Aug 2019	\$25.30	804	404
Sep 2019	\$25.30	600	600
Nov 2019	\$25.25	16	16
Dec 2019	\$25.55	1,744	602
Jan 2020	\$25.65	3	3
Feb 2020	\$25.80	403	403
Mar 2020	\$26.00	660	460
Apr 2020	\$26.10	5	5
May 2020	\$26.25	5	5
Jun 2020	\$26.40	6	6
Jul 2020	\$26.50	6	6
Aug 2021	\$28.35	200	200
Sep 2021	\$28.50	100	100
From May 2007		Totals:	121,978 2,810

Ux U₃O₈ Price vs. CME/NYMEX Forward UX Price Curve



UxC Broker Average Price (BAP) Definition

The **UxC BAP** (Broker Average Price), subject to the terms listed, is a calculated average mid-point of bid and offer prices as supplied to UxC by participating brokers. The participating brokers are Evolution Markets and Numerco Limited (the "Brokers"). Data posted by the Brokers are kept confidential and will not be published or made available independently. The Broker data are subject to verification by UxC, LLC (UxC), which compiles and reports the UxC BAP. In order to have a sufficient number of data points and to represent submissions by all of the Brokers, the UxC BAP includes the best bids and offers reported up to a three-month forward period. This period is consistent with the three-month delivery period for offers considered in the determination of the **Ux U₃O₈ Price**. On a daily basis with a cut-off time of 2:30 pm Eastern Time, the Brokers submit their best bids and offers over a forward three-month period through a secure system. From these postings, UxC separately calculates the UxC Broker Average (BA) Bid and the UxC Broker Average (BA) Offer prices. The UxC BAP is a simple mid-point average of the **UxC BA Bid** and **UxC BA Offer** prices. Other Broker data collected include lot volume on a per offer basis. The UxC BAP is published on a daily basis and is made available to subscribers through email updates and UxC's Subscriber Services website.

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