



Nuclear Fuel Market Observatory Sector

● Quarterly Uranium Market Report

2nd Quarter 2020

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International and EU developments

Monday 1st June marked the **60th anniversary of the continued operations of the Euratom Supply Agency**, the forerunner of the European agencies. When the European Atomic Energy Community (Euratom) was established in 1958 by the six founding States, its founding Treaty of Rome recognised the necessity to ensure a regular and equitable supply of nuclear materials: ores, source materials and special fissile materials to all consumers in the Community. Thus, the Supply Agency was established and started its operations on 1 June 1960. In 60 years, the market has thoroughly changed, and the Agency has always adjusted its way of working in order to ensure, across the Community, a stable supply of nuclear materials for power and non-power uses.

Global nuclear production declined in first quarter of 2020 by about 3% compared to the first quarter of 2019. According to a Global Energy Review published by International Energy Agency in April the decline was caused in part by a lower electricity demand related to the coronavirus pandemic, and also due to permanent closure of some reactors in 2019,. Although six new reactors came online since, with a capacity of 5,5 GW, they equal only half of the shutdown capacity.

IAEA assessed the impact of coronavirus on nuclear plants. The pandemic has not led to any shutdowns, but lower electricity demand caused reductions in output at multiple stations, according to IAEA report released in June. The pandemic may delay new reactor construction or plant upgrades as the effects of the pandemic may challenge the global supply chain.

According to its World Energy Investment 2020 published in May, **IEA foresees a huge decline in 2020 energy investments globally due to coronavirus pandemic.** IEA forecasts decreased by 20% (nearly \$400 billion) in 2020. The oil investments foreseen to decline the most [oil and gas is set to fall by approximately 30% in 2020 with investment in shale to fall by 50%], followed by coal estimated to fall by 25%. Expenditure related to renewables, energy efficiency, nuclear energy, and carbon capture hung at one-third over the past few years. In 2020, clean energy investments are expected to rise to 40% due to fossil fuels' decline.

Developments in the Member States

BELGIUM:

Electrabel restarted the two Units of Doel NPP respectively in May and June, after having finished the works to prepare them for long term operation. Tihange-1 will stay out of operation until the end of 2020 due to the tank failure.

Belgian nuclear regulatory authority (FANC) expressed itself in favour of a geological disposal for high-level radioactive waste. The draft proposal developed by the Belgian Agency for the Management of Radioactive Waste ONDRAF/NIRAS, was submitted to the public consultation between April and June. FANC finds that "with the scientific knowledge we have today, geological disposal is the safest long-term option".

BULGARIA:

Rosatom signed a Memorandum of Understanding with Framatome and GE Steam Power to participate together in the investor selection procedure for the Belene NPP in Bulgaria. According to the agreements, if Rosatom becomes a strategic investor in the project, GE would deliver a turbine-generator set and turbine hall equipment for the project, with Framatome becoming a key partner for instrumentation and control systems for the plant.

CZECHIA:

Czechia agreed with ČEZ on new Dukovany Unit, when the government approved in April two draft agreements with the state-owned utility ČEZ for the construction of a new nuclear reactor at the Dukovany NPP, with a capacity of 1,200 MWe. In May the Czech Prime Minister announced that the Czech state will offer ČEZ a loan for the construction of a new reactor.

In June, it was announced that ČEZ foresees to spend approx. 2 billion EUR to extend Dukovany lifespan and keep it in operation for the next 25-27 years.

FINLAND:

Finnish nuclear regulator STUK carried out a scheduled inspection of RAOS Project Oy - via Skype, due to the coronavirus situation. RAOS Project Oy, subsidiary of Rosatom, is a general supplier to the 1200MWe AES-

2006 VVER at Hanhikivi-1 NPP. Rosatom stated that the exercise on 20-22 April was the first time in history that a remote inspection of a foreign supplier of nuclear power plants was performed.

In May, STUK detected a leaking valve at Olkiluoto 3 NPP. “A leak was observed in the mechanical control valve of one of the pressurizer safety valves,” according to STUK. It noted that a full investigation of the Unit needs to be performed before issuing a nuclear fuel loading permit.

FRANCE:

EDF announced reduction of its 2020 nuclear outlook to 300 TWh due to disruption of the maintenance schedules caused by the coronavirus situation and the reduced power demand. The EDF estimation for 2021 and 2022 is in the range between 330 TWh and 360 TWh annually. In its quarterly financial results published in March 2020, EDF informed about “slowdown of projects under construction” - referring to Flamanville-3 and Hinkley Point C - due to the pandemic.

EDF permanently shutdown Fessenheim-2 in France, on 29 June. The 920-MWe Unit followed the Fessenheim-1, closed in February 2020.

LITHUANIA:

Lithuanian parliament adopted a resolution asking the government to block a project under which the Lithuanian electricity market would access electricity from Belarus and to seek sanctions against all parties involved in the project. Lithuania has since long opposed Astravyets NPP in Belarus, arguing that the two Russian VVER-1200 reactors are not being built to accepted safety standards.

NETHERLANDS:

The Petten research reactor in the Netherlands achieved a record production in May, supplying 30,000 patients with medical isotopes daily, according to the Nuclear Research and Consultancy Group (NRG). More European suppliers of radioisotopes are now reaching to NRG for supplies due to transport and logistic issues related to the coronavirus pandemic.

SLOVAKIA:

Bohunice V1 decommissioning in Slovakia achieved an important milestone in June, with the successful removal and transport of the reactor pressure vessel from Unit 1. The operation was performed despite the health and safety constraints related to the coronavirus pandemic.

Slovak nuclear regulatory authority informed about a six-month extension of the deadline for the decision authorizing the commissioning of Mochovce NPP - Unit 3 . The extension is justified by the decrease of construction activities on site due to the coronavirus pandemic. Additionally, an extensive inspection of the metallurgical materials used on the construction is being performed, triggered by the identification of lower quality materials at the Unit 4.

SPAIN:

Spanish nuclear regulatory body approved 10-year license extension for the Unit 2 of Vandellos NPP. In June, CSN approved the renewal of the operating licence of the country's largest nuclear reactor, the 1,087-MW Vandellos 2, for 10 years, following on from two other license renewals during the previous month. The extension - to be validated by the government - included 11 conditions and 15 additional technical instructions to be implemented. These are related to increased safety and maintenance. The Unit is planned to operate until 2034.

UNITED KINGDOM:

EU Advocate General supports Hinkley Point C project despite protests from Austria. The European Union Court of Justice Advocate General Gerard Hogan said in a non-binding opinion that an appeal filed by Austria intending to block state aid for the project should be dismissed.

EDF Energy reported completion of the second reactor base for Unit 2 at Hinkley Point C. The milestone was completed amid the restrictions caused by coronavirus pandemic.

... and worldwide

AUSTRALIA:

Australians support nuclear energy to improve climate. According to the Glow research published in May, almost 40% of respondents are in favour of new nuclear power plants compared to 31% of those who oppose nuclear energy.

BELARUS:

In May, fuel was delivered to Astravyets NPP Unit 1. Rosatom reported that the initial core load consists of 163 fuel assemblies manufactured by TVEL.

CANADA:

Micro Modular Reactor joint venture created in Canada at Chalk River. Global First Power, Ultra Safe Nuclear Corporation, and Ontario Power Generation joined forces to build, own and operate a Micro Modular Reactor (MMR) - 5MWe (15MWt) to generate heat and electricity for industrial applications.

CHINA:

Chinese Ministry of Ecology and Environment (MEE) assured about no negative impact of coronavirus on on-going nuclear power plant constructions. MEE Director of Nuclear Safety Inspection informed that all 15 reactors under construction are advancing.

Chinese CNNC informed about important HTGR milestone in its HTR-PM project. Steam generator shell, hot gas duct shell, and reactor pressure vessel shell were successfully paired, laying a solid foundation for cold performance testing to be completed.

China Nuclear Power Information Network announced in May, that **foundation concrete pouring started at Changjiang SMR project** - the ACP-100 (Linglong One) Small Modular Reactor (SMR) by China National Nuclear Corp. (CNNC). In July 2019, CNNC informed that the construction of the first of a kind SMR was expected to take 65 months, with a start of operation in 2025.

JAPAN:

Japanese nuclear regulatory authority (JNFL) approved in May a draft report considering that **Rokassho spent fuel reprocessing plant met the new (following the Fukushima Daiichi accident) safety standards.** JNFL intends to start the operation of the plant that faced several delays (having started construction in 1993) by September 2021.

Japan Atomic Energy Agency (JAEA) received permission to restart **the graphite-moderated helium gas-cooled (HTTR) reactor in Oarai.** The High-Temperature Test Reactor is a small prototype gas-cooled reactor with a power of 30 MWt now planned to be used for production of hydrogen.

RUSSIA:

Russian floating NPP entered commercial operation in May. The plant aboard the Akademik Lomonosov consisting of 2 KLT-40S reactors with an electricity capacity of 35 MWe each is the northernmost one in the world.

Rosatom informed that its fast reactor Unit 4 of the Beloyarsk NPP is to be converted to **MOX fuel in 2022.** This is an important step towards closed nuclear fuel cycle, from current 'hybrid core' using a mix of uranium and plutonium oxides.

UKRAINE:

Ukraine assured that there were no changes to background radiation levels from forest fire that broke on the western tip of the exclusion zone of the Chernobyl NPP.

USA:

The US Nuclear Fuel Working Group published its Restoring America's Competitive Nuclear Advantage (A strategy to assure U.S. National Security)¹, in which it recommends taking "immediate and bold action" to strengthen the domestic uranium mining and conversion industries and "restore the viability" of the entire front-end of the nuclear fuel cycle.

Indian Point 2 shutdown definitely in April, after 45 years of operation. Entergy Corp. announced that Unit at the site is scheduled to permanently shut down by April 30, 2021. The closure of both Indian Point reactors results from many factors, including sustained low current and projected wholesale energy prices that reduced revenues.

Centrus Energy Corp. announced in April the signature of a Letter of Intent (LOI) with Advanced Reactor Concepts, LLC, (ARC) to work together on supporting deployment of U.S. uranium enrichment capacity to produce High Assay Low Enriched Uranium (HALEU) to be used in the existing and next-generation advanced reactors (like ARC's sodium-cooled ARC-100 fast reactor). Centrus currently advances with a three-year contract with the U.S. Department of Energy to deploy 16 C-100M centrifuges to demonstrate production of HALEU with U.S. technology in Ohio. The demonstration program lasts until 2022, when Centrus should have a licensed and operable HALEU production capability.

US uranium production decreased by 76% compared to 2019. US uranium production dropped to 174,000 lb U3O8 in 2019, 76% less than the 721,000 lb produced in 2018, according to the US Energy Information Administration annual uranium report². It was also 85% below the 1.15 million lb produced in 2017. US uranium output in 2019 was the lowest since 1949, when 360,000 lb were produced.

U.S. Secretary of State Michael Pompeo announced in May the end of sanctions waivers concerning all remaining JCPOA-originating nuclear projects in Iran. This covers the Arak reactor conversion, the provision of enriched uranium for the Tehran Research Reactor, and the export of Iran's spent and scrap research reactor fuel. The sanctions waivers will end following a final 60-day wind-down period (Bushehr NPP received a 90-day extension to ensure safety of operations) to allow companies and entities involved in these activities to cease operations. Pompeo stated the waivers were cancelled because of "escalatory actions" in Iran's nuclear sector that threaten global security.

¹ <https://www.energy.gov/downloads/restoring-americas-competitive-nuclear-energy-advantage>

² <https://www.eia.gov/uranium/production/annual/pdf/dupr2019.pdf>

Uranium production

Coronavirus pandemic has significantly influenced uranium market as several companies announced in the second quarter the measures leading to an important decrease of uranium production and related services. As a consequence, market got very active and spot U3O8 prices have risen substantially with a further upward expectations. The conversion market that experienced price increases in the past two years due to supply reductions and inventory drawdowns is likely to experience the same situation.

Another impact of the pandemic on the suppliers is that their inventories are getting quickly lower, while utilities may be trying to revise their supply contracts or to build the stock considering the security of their supplies and future price increases. Hand in hand went the news from Cameco expecting to buy more U3O8 than it delivers in 2020 due to mine shutdown and the information from Kazatomprom that foresaw output falling by 15.5% in 2020. However, Kazatomprom assured that the reduced production level is "not expected to impact Kazatomprom's 2020 sales obligations".

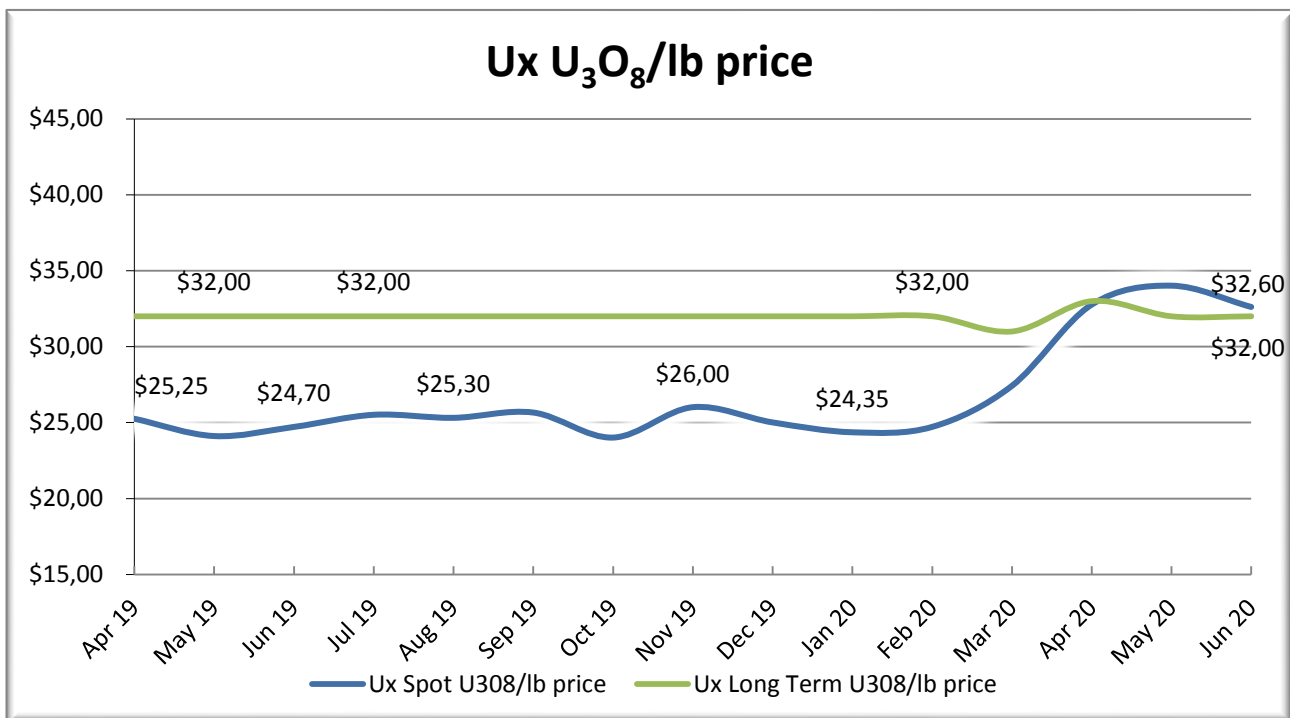
In June, the Pakistanese government approved uranium exploration in Bannu basin and Kohat plateau.

The Wyoming Department of Environmental Quality gave final approval for Peninsula Energy's Lance Project to demonstrate the use of low-pH solution for in-situ recovery of uranium. The decision to finally use low-pH operations at Lance Project would be subject to the favourable uranium prices. According to the Peninsula CEO Wayne Heili, the advantages of using low-pH sulfuric acid solution include "much higher uranium recovery" and a "much faster extraction rate" compared with alkaline solution, which all other US producers continue to use. Alkaline solutions resulted in 50% uranium recovery from the fluids used, while the low-pH solution is expected to result in 90% recovery, he said.

Uranium prices³

In the second quarter of 2020, the UX monthly spot uranium price increased by almost 19% comparing quarter to quarter and, at the end of June, it accounted for USD 32.60/lb U₃O₈. It was up by almost 32% in an annual comparison.

The UX long term uranium price for the second quarter of 2020 accounted for USD 32.00/lb U₃O₈ at the end of June which is more than 3% up when compared quarter to quarter and it did not change in an annual comparison.

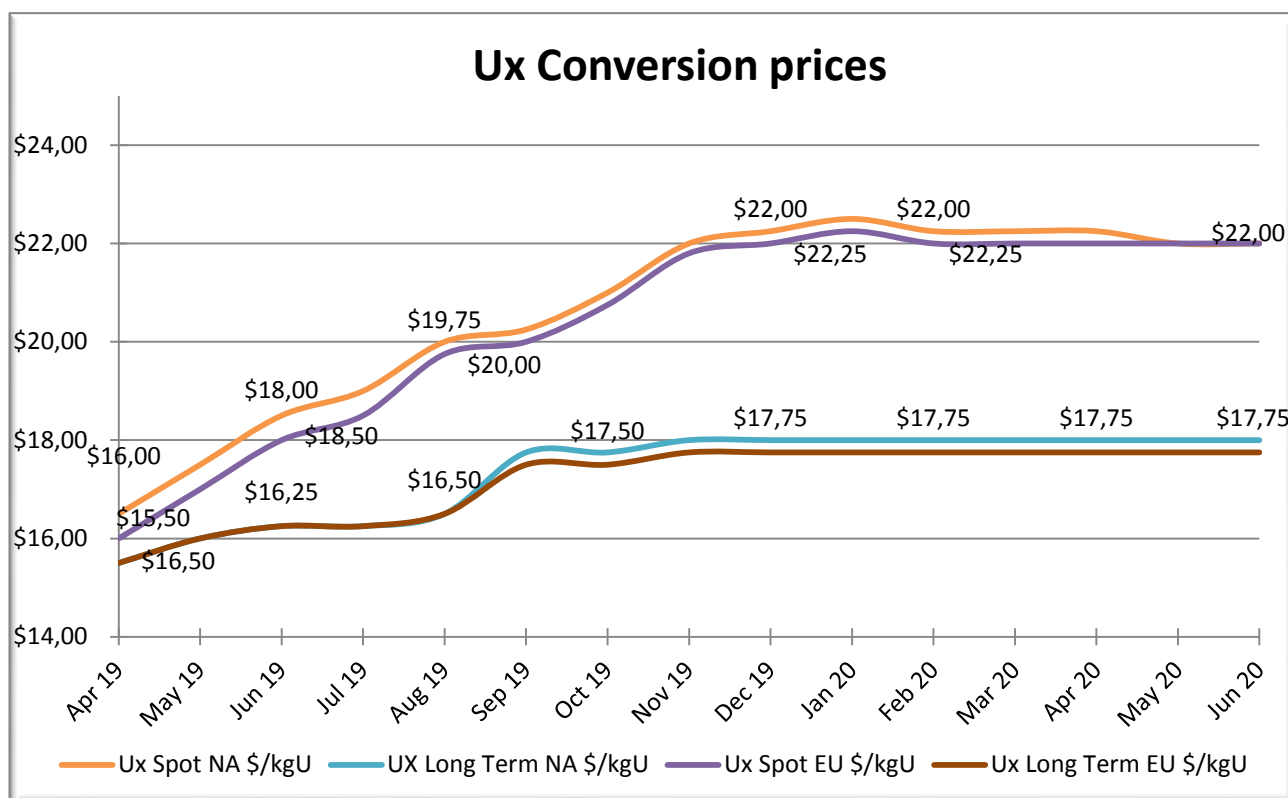


³ The market price information in the following chapters: Uranium prices, Conversion and Enrichment is provided with permission of the Ux Consulting Company, LLC (UxC) www.uxc.com. UxC does not bear any legal liability for the use of these data

Conversion

In the second quarter of 2020 UX spot conversion price in the European Union did not change and in North America it dropped by 1% compared to the previous quarter and amounted to USD 22.00/kg in the EU and in North America at the end of June. In an annual comparison, they increased by 22% and 19%, respectively.

UX long term conversion prices amounted to USD 17.75/kg in the EU and USD 18.00/kg in North America, which means no change, when compared to the previous quarter. They increased by 9% and 11% respectively in an annual comparison.

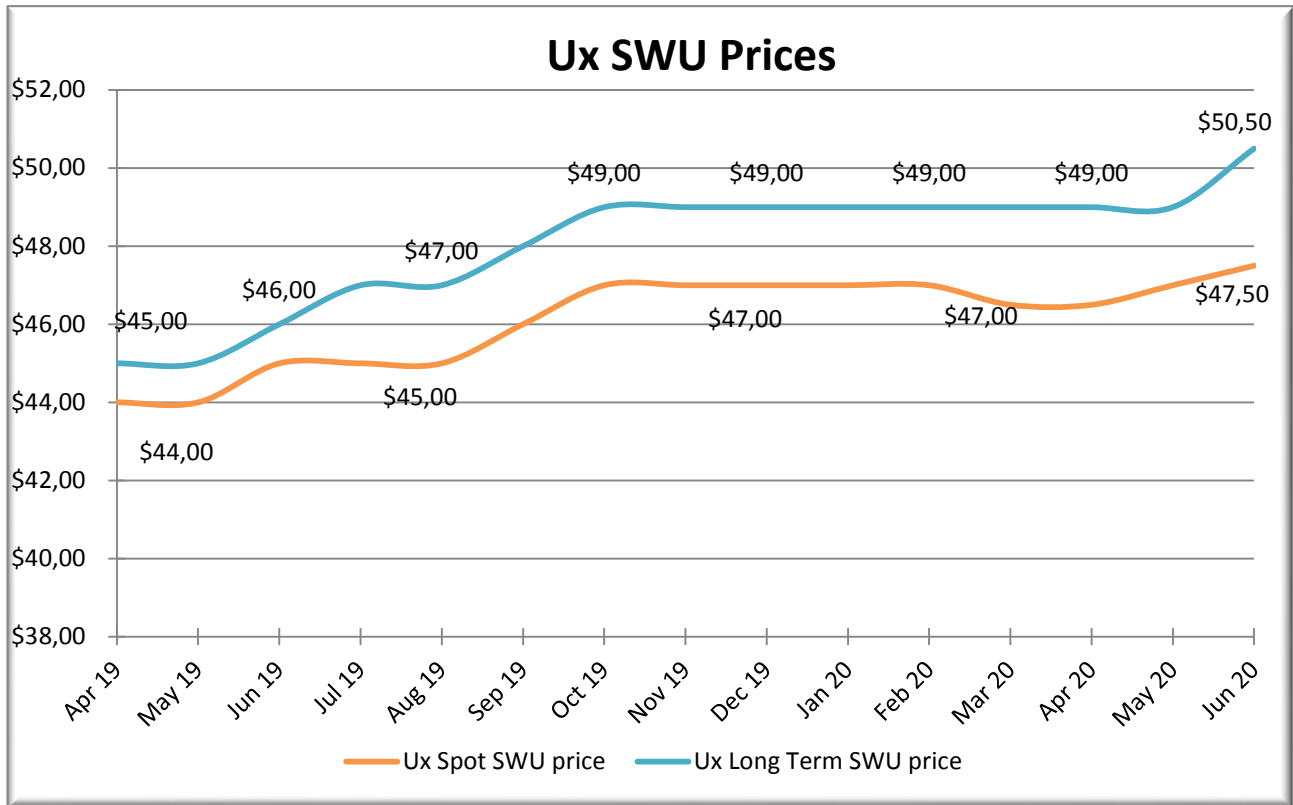


Coronavirus pandemic influenced negatively the operations of Cameco. The company was forced to temporary suspension of its facilities: the UF6 plant at the Port Hope Conversion Facility and the Blind River Refinery throughout the month of April. Anti-covid 19 measures were put in place and some maintenance works planned for later-2020 were advanced. Both facilities were reopened in May.

Enrichment

At the end of June 2020, the UX spot SWU price amounted to USD 47.50 per SWU and it increased by more than 2% compared to the previous quarter. It was up more than 5% in an annual comparison.

The UX long term SWU price amounted to USD 50.50 and it increased by 3% compared to the previous quarter and by almost 10% compared to the second quarter of 2019.



Daher Nuclear Technologies foresees in 2021 for a license application for a new UF6 transportation cylinder for HALEU. The company is developing a safety analysis report for the transportation cylinder, the DN-30X. The analysis will assess a cylinder for enrichment up to 10% U-235 and another one for enrichment up to 20% U-235.

The US Nuclear Regulatory Commission accepted for review **Centrus Energy Corp's application** to produce HALEU. Once licensed, Centrus could enrich uranium up to 20%.

Fuel fabrication

X-Energy informed that it signed an agreement with the Massachusetts Institute of Technology (MIT) to irradiate its TRISO-X fuel in MIT research reactor. The gathered data will be used for licensing X-energy's Xe-100 and other reactors.

TVEL announced the start of tests of its RK3+ fuel intended for VVER-440 reactors. The new fuel, which will be tested in Dukovany, Czechia, allows for operation with increased thermal capacity and to extend the fuel cycle at the plant, leading to better economic efficiency. TVEL also started preparatory works to fabricate MOX fuel for its demonstration fast neutron reactor Brest-300.

Unit 2 of the South Ukraine nuclear power plant becomes the third Ukrainian VVER-1000 reactor fully loaded with fuel supplied by Westinghouse, Energoatom informed in June, after the core was loaded with TVZ-WR assemblies.

Nuclear medicine

Coronavirus pandemic influenced also the transport of medical radioisotopes globally, but the situation should be getting better as the situation in aviation industry is improving. According to Nuclear Medicine Europe (NMEu), despite the improvement there are still some difficulties in transporting radioisotopes to certain regions. However, no specific shortages are presently foreseen. The nuclear medicine procedures are expected to increase shortly and there should be no problems meeting the demand.

Belgian Institute of Radioelements started production of the medical radioisotope molybdenum-99 (Mo-99) using a low-enriched uranium (LEU) target instead of a high-enriched uranium one. LEU target was irradiated in the Belgian Research Reactor 2, operated by SCK-CEN in Mol.

Concluded natural uranium contracts in the EU⁴

Quarter	ESA quarterly spot uranium price EUR/kgU	ESA quarterly spot uranium price USD/lb U ₃ O ₈	ESA All Users quarterly spot uranium price EUR/kgU*	ESA All Users quarterly spot uranium price USD/lb U ₃ O ₈ *	Number of spot natural uranium contracts concluded by EU utilities**	Number of spot natural uranium contracts concluded by all parties**	Total number of contracts processed by ESA***
2019 Q3	-	-	60.73	25.98	3	8	86
2019 Q4	-	-	-	-	4	7	84
2020 Q1	-	-	-	-	1	6	63
2020 Q2					4	9	65

* prices converted with use of ECB reference exchange rate (www.ecb.europa.eu)

** including purchases, sales, exchanges and loans

*** including contracts, amendments and notifications on the front-end activities

List of common abbreviations:

ESA	Euratom Supply Agency
IAEA	International Atomic Energy Agency
OECD	The Organisation for Economic Co-operation and Development
(US) DoE	United States Department of Energy
(US) EIA	United States Energy Information Administration
WNA	World Nuclear Association
NA	North America
USEC	United States Enrichment Corporation
NPP	Nuclear Power Plant
PWR	Pressurized Water Reactor
ABWR	Advanced Boiling Water Reactor
EPR	European Pressurised Water Reactor
VVER	Water-Water Power Reactor
SWU	Separative Work Unit
tU	tonne U (= 1 000 kg uranium)

⁴ The statistics and data analysis provided by ESA are for information purposes only, and ESA does not bear any legal liability for using them. ESA ensures confidentiality and physical protection of the commercial data.