



EURATOM Supply Agency

Nuclear Fuel Market Observatory Sector

● Quarterly Uranium Market Report 3rd Quarter 2019

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International and EU developments

On July 22, the Director General of the IAEA since 2009, Yukiya Amano, passed away at the age of 72. A memorial service was held at the IAEA headquarters in Vienna in August, where diplomats and colleagues paid their tributes. Cornel Feruta, a Romanian diplomat, was designated as acting Director General until the selection and appointment of Mr Amano's successor¹.

World Nuclear Association (WNA) published the World Nuclear Performance Report for 2019² at the end of August. According to the report, electricity generated by nuclear reached 2 563 TWh in 2018, which was the 6th consecutive year of growth. Nuclear represented 10% of electricity generation worldwide, seeing nine newly built reactors and seven permanent shut-downs - total capacities being 10.4GWe for new reactors and 5.4 GWe for the closed ones. The report stated also a growth in construction times, which was typically around eight and a half years in 2018, compared to five to six years earlier years. This is due primarily to new designs and therefore it is expected that the construction times will go down again in 2019. In the report's preface, WNA Director General Agneta Rising stated that "greater commitment from policymakers will be required" in order for the nuclear industry to reach the 25% share of world's electricity production by 2050.

Also IAEA presented in its annual report³ the 10% share of nuclear of the total global electricity in 2018, with a one third of all low-carbon electricity. The report was released on 10 September, presenting different scenarios - low and high cases - to forecast nuclear power's share in the global electricity generation by 2050. According to the low case scenario, the nuclear power generation will grow from 2 563 TWh in 2018 to 2 990 TWh in 2050, but the share of nuclear in the overall electricity production will drop from 10.2% in 2018 to 6.1% in 2050. The high case scenario respectively predicts a growth to 5.761 TWh by 2050, the share of nuclear increasing to 11.7% of the overall global electricity production.

Developments in the Member States

BELGIUM:

Belgian electricity grid operator Elia published a report "Adequacy and flexibility study for Belgium 2020-2030"⁴ at the end of June 2019. According to the report, more capacity is needed in Belgium in order to cope with the planned phase out of nuclear reactors. One option to manage the issue is to close down reactors in a more gradual manner than by 2025 as foreseen. The Government was urged to ensure the sufficient resources to avoid a capacity crisis.

BULGARIA:

Bulgaria's energy minister Temenuzhka Petkova informed in a press conference in August that seven companies have expressed their interest to participate in the construction of the proposed Belene NPP, as a response to a tender that closed on 19 August. The seven companies in question are Korea Hydro & Nuclear Power, Rosatom, China National Nuclear Corp. and Becktron-Liaz, as well as Bulgarian NPP Belene, IPK and UP.

¹ On 30 October, the IAEA's Board of Governors appointed Rafael Mariano Grossi as the new Director General, who will take office in the beginning of December 2019.

² <https://www.world-nuclear.org/our-association/publications/online-reports/world-nuclear-performance-report.aspx>

³ <https://www.iaea.org/opic/annual-report-2018>

⁴ https://www.elia.be/en/news/press-releases/2019/06/20190628_press-release-adequacy-and-flexibility-study-for-belgium-2020-2030

CZECHIA:

An agreement was signed in the beginning of July between the nuclear research centre Centrum výzkumu Řež (CVR) and Russian fuel company TVEL for CVR to carry out tests on specialised metals and alloys used in TVEL fuel assemblies. The focus of the tests will be on zirconium, chrome-nickel and steels alloys behaviour - among other materials - when radiated. These tests will facilitate TVEL to validate the operational characteristics of the fuel assemblies, as well as to establish their corrosion and fatigue characteristics and behaviour during dry storage and under critical conditions in water.

In September, the Czech power company ČEZ announced its intentions to focus on its domestic nuclear power and renewable generation and therefore selling its Distributie Energie Oltenia - regional electricity distribution business, a wind farm and 22MW hydro generation capacity.

FINLAND:

On 17 July, Teollisuuden Voima Oyj (TVO) informed about having received an updated schedule from AREVA-Siemens Consortium for completion of the Olkiluoto Unit 3 EPR. The updated plan schedules the start up for July 2020 - a delay of six months compared to the previous timetable, due to the modification works at the reactor.

A contract was awarded at the end of August to a construction company YIT by the Finnish nuclear waste management company Posiva for the second phase of excavation works for final disposal facility Onkalo in Olkiluoto. The value of the contract is about EUR17 million and covers two central and five deposition tunnels. The work will start at the end of 2019 and will last for around two and a half years.

In September, Posiva laid the foundation stone in a celebratory ceremony for the spent fuel encapsulation plant to be built in connection to the final disposal facility in Olkiluoto. The cost estimate for both the repository and the encapsulation plant is about EUR500 million and has around 2500 person years employment impact.

FRANCE:

In the beginning of July the French Government requested an independent audit concerning the Flamanville 3 EPR construction project, due to cost and schedule problems. Bruno Le Marie, minister of Economy, has asked Jean-Martin Folz - a former executive of car maker PSA - to take this task, nevertheless no specific timeframe was communicated.

France's EDF signed a Memorandum of Understanding, on cooperation in the fields of nuclear safety and additive manufacturing, with China National Nuclear Corp. (CNNC) during the third Sino-French Seminar on Nuclear Technology Innovation on 24-25 June at the Fuqing NPP in China. A joint committee is to be established and chaired by CNNC and EDF in a rotating manner. EDF also signed a cooperation agreement with the Nuclear Power Institute of China on analog computation of the glow-induced vibration in steam generator tubes.

In August, France's Atomic Energy Commission (CEA) decided to discontinue the development of the Advanced Sodium Technological Reactor for Industrial Demonstration (ASTRID). According to CEA, due to the current energy market situation the development of generation IV reactors is not planned at the first half of the century.

As a consequence to the decision to halt the ASTRID project, France will now use its plutonium stocks in MOX fuel to be used in their 1,300 MW light-water reactors and reprocess spent MOX fuel, according to Valeria Faudon, delegate-general of the French Nuclear Society (SFEN).

In September CEA, EDF, Naval Group and TechnicAtome jointly unveiled a new small modular reactor design NUWAR with a 300-400 MWe capacity. The partners are open to international cooperation and have already having discussions with Westinghouse on potential cooperation.

ROMANIA:

Romanian Prime Minister Viorica Dăncilă and US Secretary of Energy Rick Perry signed a Memorandum of Understanding on cooperation on civil nuclear energy on 24 September, during the UN Climate Action Summit, held in New York. According to the US State Department, the Memorandum strengthens the ties between Romania and the US in the area of cooperation and supports their respective energy security goals, as well as signals the long-term commitment to develop Romania's civil nuclear programme and pursue the peaceful uses of nuclear energy.

SLOVAKIA:

On 19 July Slovakian President Zuzana Caputkova vetoed the proposed changes to Slovakia's nuclear energy law, after it had been approved by the Parliament on 27 June. The law would have simplified the functioning of the national Nuclear Supervisory Authority by removing some duplication of procedures, but in the President's opinion there were too many simplifications which conflicted Slovakia's international commitments under the Aarhus Convention from 1998. The President said she would sign the law in case the proposal was modified in this respect.

Nevertheless, as a reaction to this, the Slovak Parliament overturned the President Caputkova's veto on 10 September, a two thirds majority that was required for this result was reached with votes 81 to 16 and 49 abstentions.

SLOVENIA:

On June 22 Prime Minister Marjan Sarec informed, during a visit to Krško NPP, that he is supporting the plans to build a new nuclear reactor in Slovenia. The current reactor is a 969 MWe PWR is jointly owned with Croatia with an operating license until 2043. The second unit would satisfy the increasing electricity demand.

UNITED KINGDOM:

As a response to the 2014 White Paper on implementing geological disposal setting actions - to develop land-use planning processes, to prepare working with communities and to carry out national geological screening - the UK Department for Business, Energy & Industrial Strategy (BEIS) announced in July that the revised UK's draft National Policy Statement (NPS) for geological disposal infrastructure will be set down in Parliament soon. The draft NPS completed the initial action on national land-use planning. The siting process, which started in England in December 2018 and in Wales in January 2019, may last up to 20 years and during that time a detailed technical work can take place to assess the suitability of the sites for radioactive waste management and geological disposal facility.

After announcing the completion of pouring of concrete to form the base of the first reactor at Unit 1 of the Hinkley Point C at the end of June, EDF informed in September about the updated estimates of the project cost. Since the previous estimate, which was GBP19.6 billion, the cost is now estimated to be between GBP21.5 billion and GBP22.5 billion. Nevertheless, according to the term of the contract-for-difference, it will not impact UK consumers or taxpayers.

On June 27, the UK BEIS and Member of Parliament, Chris Skidmore signed legislation putting the UK as the world's first major economy having laws preventing contributions to global warming by 2050. According to the new legislation, the country should stop all the greenhouse gas emissions by 2050, compared to the previous legislation which required only minimum 80% reductions from the 1990 levels. According to BEIS, UK has already reduced its carbon emissions by 42% - with a simultaneous growth of economy by 72% - under the "Industrial Strategy".

The UK's Nuclear Decommissioning Authority announced in September the final shipment of the used nuclear fuel from the Wylfa site in Wales having taken place. This was the last step of defueling all the UK Magnox sites, which consisted of 26 reactors, Wylfa being the biggest. The two reactors of the Wylfa site had been in operation from 1971 to 2015 (Reactor 1) and from 1972 to 2012 (Reactor 2). The removed used fuel after the end of operation has been shipped to Sellafield for reprocessing - a total of 87 890 fuel elements.

... and worldwide

AUSTRALIA:

Australia's Energy Minister Angus Taylor made a formal request in August to the national Parliament's Environment and Energy Committee to carry out a survey on the potential use of nuclear energy in Australia, in order to address the opportunities and challenges of developing a nuclear power programme. The last time a similar study was made was more than ten years ago. The new study would take into account the economic, environmental and safety aspects of use of nuclear power.

BELARUS:

On 3 September the engineering division of Rosatom - ASE - informed about the completion of hydraulic tests of primary circuit at Ostrovets NPP Unit 1, which is a VVER-1200 reactor under construction. After the completion of these hydraulic tests, primary circuit's safety systems are being tested. The operation of the Unit 1 is scheduled to start by the end of 2019, followed by the start of commissioning of the second reactor - similarly a VVER-1200 reactor - in 2020.

CANADA:

The Canadian federal government began the environmental assessment of the proposed 5MW micro reactor in July. The Micro Modular Reactor project is the first of its kind in the country and is a joint effort of Ultra Safe Nuclear Corporation, Global First Power and Ontario Power Generation (OPG). According to the proposal, the reactor is designed by Ultra Safe Nuclear Corporation and would be operated by OPG. The environmental assessment is required to enable the Canadian Nuclear Safety Commission to make a licensing decision. The proposal which is under assessment consists of a high-temperature gas-cooled reactor with 5 MW electric or 15 MW thermal power - or combination of the two - to be built at Atomic Energy of Canada owned Chalk River Laboratories in Ontario. The environmental assessment is likely to take about two years to complete, and the reactor operation is planned to start in 2026.

CHINA:

China National Nuclear Corp. (CNNC) confirmed in July the pouring of the first concrete in December for the Linglong One (ACP100) small modular reactor at the Changjiang NPP site. The Linglong One is the first SMR to have passed the IAEA's safety review in 2016 and got the approval from China's National Development and Reform Commission in 2017. The reactor will be installed underground with a planned start of operations in May 2025.

China's National Energy Administration announced in July the first approvals by the Chinese regulators for new reactors since 2015. Three sites received approvals for two reactors each, namely Taipingling (also known as Huizhou), Rongcheng and Zhangzhou.

On 7 August France's Framatome announced that Unit 2 of the Taishan NPP in China had reached 100% nominal power. Guangdong Taishan Nuclear Power Joint Venture Co. Ltd. - China General Nuclear with 70% share and 30% share of EDF - is the constructor and owner of the reactor. Construction of this 1,700 MWe EPR started in 2010, one year after the start of construction of Taishan 1 which entered into commercial operation in December 2018. Taishan 2 is expected to start commercial operation by the end of 2019.

JAPAN:

It was ruled by the Tokyo District Court in September that the three former executives of Tokyo Electric Power Co are not guilty of professional negligence during the 2011 accident at Fukushima I NPP caused by earthquake-triggered tsunami. Tsunehisa Katsumata, Tepco's former chairman and two former vice presidents Ichiro Takekuro and Sakae Muto, who were facing charges on failing to prevent the accident, were acquitted by the court. In its statement, Tepco apologized those affected by the accident, stating the company's determination to continue the efforts related to compensation, decommissioning and decontamination.

RUSSIA:

The conclusion made by the scientific journal Proceedings of the National Academy of Sciences of the United States of America, stating the release of the isotope ruthenium-106 detected across Europe at the end of 2017 originated from the reprocessing plant situated in the Russian southern Urals region, was contested by the Russian state nuclear corporation, Rosatom, in July. According to Rosatom the activities at the Mayak facility at the time of the incident were such that they would contain only barely detectable traces of ruthenium-106.

Rosatom started towing the floating NPP Akademik Lomonosov from Murmansk to its permanent base in Pevek, Chukotka on 23 August. After 4 700 kilometers it reached Pevek on 14 September, where it will be supplying electricity to the city of Pevek and the Chukotka Autonomous Region, replacing the Bilibino NPP which is to be decommissioned.

At the end of August the Government of Yakutia Republic in the north-east of Russia announced the plans to build several small modular reactors. An agreement to develop a financial model for the project as well as site selection was signed by the Governor of Yakutia Aisen Nikolaev and general director of Rosatom Alexey Lihahev.

UKRAINE:

A contract was signed on 29 July between SSE Chernobyl NPP and construction company Ukrbudmontazh to create an infrastructure for early dismantling of Shelter Object, also known as “sarcophagus”. The value of the contract is over UAH2 billion (EUR 74.6 million).

USA:

President Trump decided on 12 July not to oblige US utilities to have a domestic uranium quota in their acquisitions. According to President Trump, the challenges the domestic uranium producers face are not of national security importance, but a broader analysis of national security considerations for the entire nuclear supply chain is to be carried out. A Nuclear Fuel Working Group was established, with a task to develop recommendations for the White House to revive and expand domestic nuclear fuel production. The timeline given for this task was 90 days.

In August the US added China General Nuclear (CGN) to the list of companies the US Government considers as a national security threat. This establishes additional limitations for the US companies to their business relations with CGN as well some of its subsidiaries. On 14 August the US Department of Commerce added four Chinese companies to the list of entities determined by the US Government to be acting contrary to the national security of foreign powers interest of the US. These three companies, in addition to their parent company CGN, are China General Nuclear Power Corp., China Nuclear Power Technology Research Institute Co. and Suzhou Nuclear Power Research Institute Co.

On 9 September the US House of Representatives passed a legislation directing the Office of Nuclear Energy to develop and deploy high-assay low enriched uranium (HALEU) for commercial use in the US. This would allow the Secretary of Energy to assist financially commercial entities to design HALEU transportation packages, to be certified by NRC by January 2024. Uranium quantities available at the Department of Energy for processing to HALEU are to be reported to Congress by 1 January 2021. Concerning the costs, Secretary will develop a schedule for cost recovery of HALEU, and at least 20% of the costs related to design and license activities are to be covered by a non-federal entity, under the Advanced Nuclear Fuel Availability Act. For the HALEU to be commercially available, NRC will identify the needs to update its regulations, certifications and other regulatory policies.

At midday on 20 September and after 45 years of operation the Three Mile Island NPP Unit 1 retired for economic reasons. Simultaneously hundreds of people demonstrated demanding the state to prevent the planned shut-down of the Beaver Valley NPP in 2021.

Uranium production

The US Energy Information Administration released its second quarter report⁵ on 1 August. According to the report, the US uranium production continued to drop, totalling 44 569 lb U₃O₈ in the second quarter, compared to 58 481 lb in the first quarter and 365 421 lb during the second quarter in 2018 - declines of 24% and 88% respectively, a result of low uranium prices. When comparing the production during the first half of the year, the drop was 83% from 592 201 lb in 2018 to 103 050 lb in 2019, which was the lowest production year since at least 1995. The uranium produced came from four sites: Lost Creek, Nichols Ranch, Ross and Smith Ranch-Highland.

On 6 August, Ur-Energy announced cutting its uranium production for the rest of the year, in order to cut costs after President Trump rejected the domestic uranium quota. At its Lost Creek facility the yearly production guidance was dropped to 50 000-75 000 lb U₃O₈ from the previous guidance from April which was 75 000-100 000 lb.

Peninsula CEO Wayne Heili informed on 7 August that the company has received on 31 July a final regulatory approval to deploy sulphuric acid at its Lance project in Wyoming and begin commercial low pH uranium recovery, starting in September. Since 2015 the company has been using an alkaline lixiviant in its U₃O₈ mining.

On 20 August, the Kazakh national uranium company Kazatomprom gave a statement on its production plans. According to the statement, the production will remain below 23 000 mtU, which is 20% under the permitted amounts in 2021, as a result from the low uranium prices. It will be the fourth consecutive year with production limited to that level.

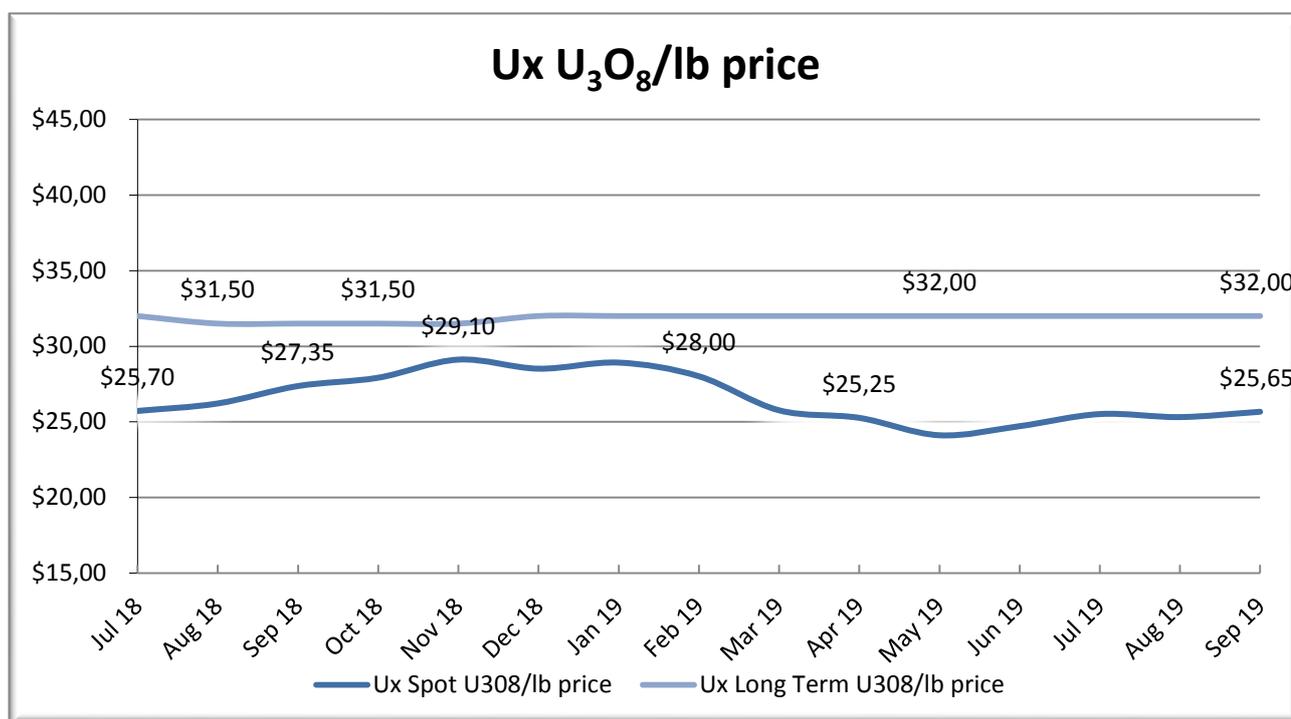
In the beginning of September, the French company Orano Group and Uzbekistan's State committee for Geology and Mineral Resources, GoscomGeology, signed a partnership agreement to develop mining exploration and operations in Uzbekistan. A joint venture will be created with a 51% share held by Orano and 49% by GoscomGeology to develop mining projects in Navoiy region of Kyzylkum province, in the first half of 2020.

⁵ <https://www.eia.gov/uranium/production/quarterly>

Uranium prices⁶

In the third quarter of 2019, the UX monthly spot uranium price decreased by almost 4% comparing quarter to quarter and, at the end of September, it accounted for USD 25.65/lb U₃O₈. It was down by more than 6% compared to the third quarter of 2018.

The UX long term uranium price for the third quarter of 2019 accounted for USD 32.00/lb U₃O₈ at the end of September which means no change when compared quarter to quarter and more than 1% up compared to third quarter of 2018.

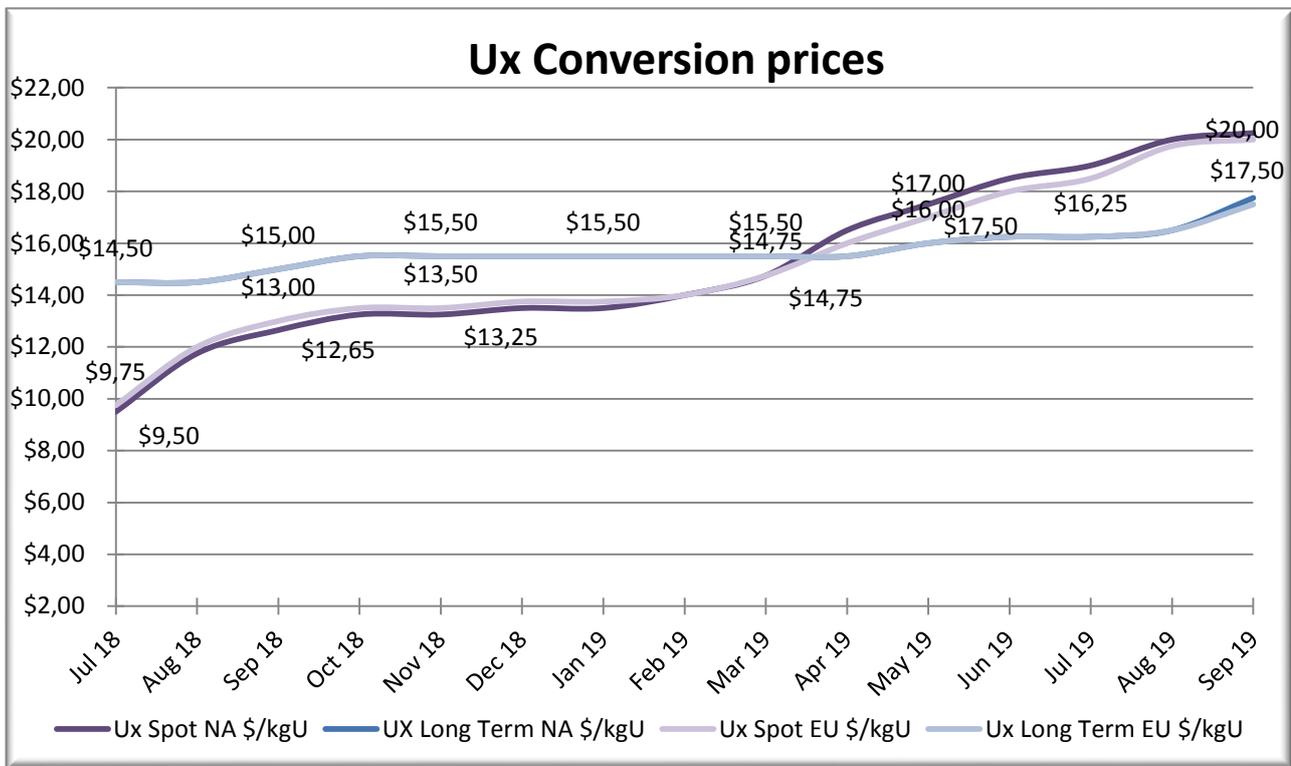


⁶ The market price information in the following chapters: Uranium prices, Conversion and Enrichment is provided with permission of the Ux Consulting Company, LLC (UxC) www.uxc.com. UxC does not bear any legal liability for the use of these data

Conversion

In the third quarter of 2019, UX spot conversion prices in the European Union and in North America increased by 11% and 9%, respectively, compared to the previous quarter and amounted to USD 20.00/kg in the EU and USD 20.25/kg in North America at the end of September. They were reported higher than UX long term conversion prices. In an annual comparison, they increased by 17% and 54%, respectively.

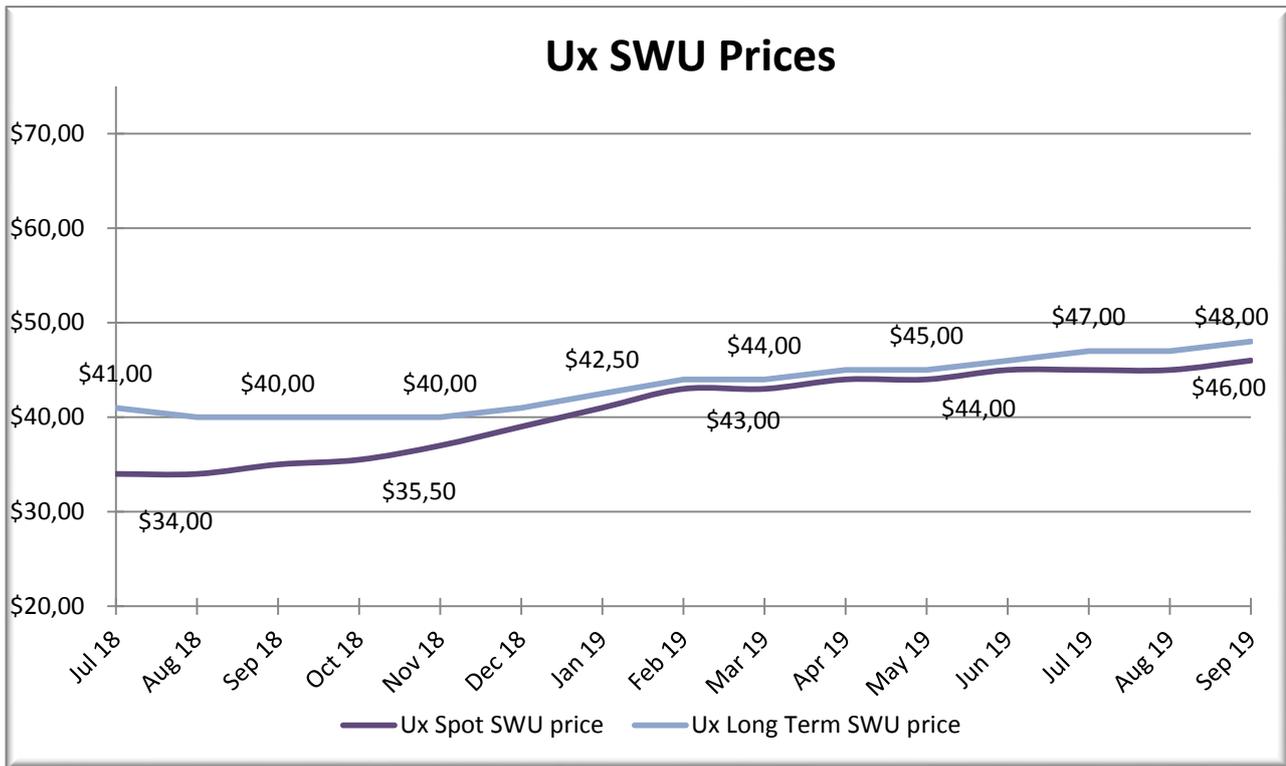
UX long term conversion prices amounted to USD 17.50/kg in the EU and USD 17.75/kg in North America, which was 8% and 9% up respectively, when compared to the previous quarter. They increased by 17% and 18% respectively in an annual comparison.



Enrichment

At the end of September 2019, the UX spot SWU price amounted to USD 46.00 per SWU and it increased by more than 4% compared to the previous quarter. It was up 31% in an annual comparison.

The UX long term SWU price amounted to USD 48.00 and it was up by more than 4% compared to the previous quarter and increased by 20% compared to the third quarter of 2018.



On 9 September the new energy minister of Saudi Arabia, Prince Abdulaziz Bin Salman Al Saud, who was appointed on 8 September, informed of the possibility of the country to use its uranium sources as a basis to build independency as regards to nuclear fuel, including enrichment, to supply more nuclear fuel than needed for the country's two planned power reactors.

Fuel fabrication

Russian nuclear fuel company TVEL gave a statement in the beginning of July, according to which TVEL has supplied a fuel batch for the Chinese 20MW experimental fast reactor (CEFR). The fuel assemblies shipped to the CEFR were manufactured at the Machine-Building Plant in Elektrostal in Russia and were supplied under a broader supply contract between TVEL, China Nuclear Energy Industry Corp. and the China Institute of Atomic Energy in Beijing. The volume or the value of the shipment was not communicated.

On 29 July TVEL JSC informed on having signed a contract with the Czech national power company ČEZ, under which TVEL JSC is to supply new fuel design RK 3+ to the Czech Dukovany NPP. The new fuel design, which increases fuel efficiency by having a longer fuel rod pitch to streamline the water to uranium ratio in the reactor core, is to be tested and licensed by the Czech State Office for Nuclear Safety.

According to the statement of Ukraine's nuclear power generator Energoatom and Westinghouse on 4 September, the two companies have signed a preliminary agreement for Westinghouse to produce fuel for Ukraine's VVER-440 reactors, operated by Energoatom. The agreement enables Ukraine to reduce its dependence on Russian fuel supplier TVEL and to work together with Westinghouse to develop and implement advanced VVER fuel technologies. A feasibility study will be completed by the end of 2019 to allow the design and fabrication of VVER-440 fuel assemblies. Both the technology and the costs will be shared by the two companies.

China National Nuclear Corporation (CNNC) announced in its press release on 3 September, that its subsidiary Nuclear North Nuclear Fuel has delivered the first batch of China-fabricated fuel assemblies to the world's first AP1000 reactor Sanmen 1. CNNC informed also its intentions to fabricate fuel assemblies for CAP-1400 reactors.

Westinghouse's Encore accident tolerant fuel (ATF) was for the first time loaded into a reactor core on 5 September. Two test ATF assemblies were placed into Exelon's Byron NPP Unit 2.

Nuclear medicine

Three US companies - Niowave Inc., NorthStar Medical Radioisotopes LLC and Shine Medical Technologies - have been awarded agreements in July for the production of molybdenum-99 (Mo-99) without the use of highly enriched uranium (HEU), by the US Department of Energy's National Nuclear Security Administration NNSA.

Also in July, NorthStar Medical Radioisotopes completed the construction of company's non-uranium based Mo-99 processing facility in Beloit, Wisconsin which uses the NorthStar's RadioGenix System to separate technetium-99m from Mo-99.

Consecutively in August, a cooperative agreement was awarded by NNSA to Northwest Medical Isotopes for the production of Mo-99 without the use of HEU, being the last such award during the NNSA fiscal year 2019.

On 6 September, a fault was detected in a valve at the ANSTO's Mo-99 processing facility. The production is limited for the time being, satisfying only the domestic needs in Australia, supplies to abroad are expected to restart only after fulfilling additional regulatory requirements.

Concluded natural uranium contracts in the EU⁷

During the third quarter of 2019, ESA processed 86 transactions, including contracts, amendments and notifications on the front-end activities. Between July and September, European utilities concluded 3 new spot natural uranium supply contracts (including purchases, sales, exchanges and loans) and 2 new long term contracts.

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***
2018 Q4	62.39	27.39	55.35	24.30	8	18	75
2019 Q1	-	-	65.33	28.54	8	10	87
2019 Q2	-	-	-	-	2	3	55
2019 Q3	-	-	60.73	25.98	3	8	86

* 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)

⁷ 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.