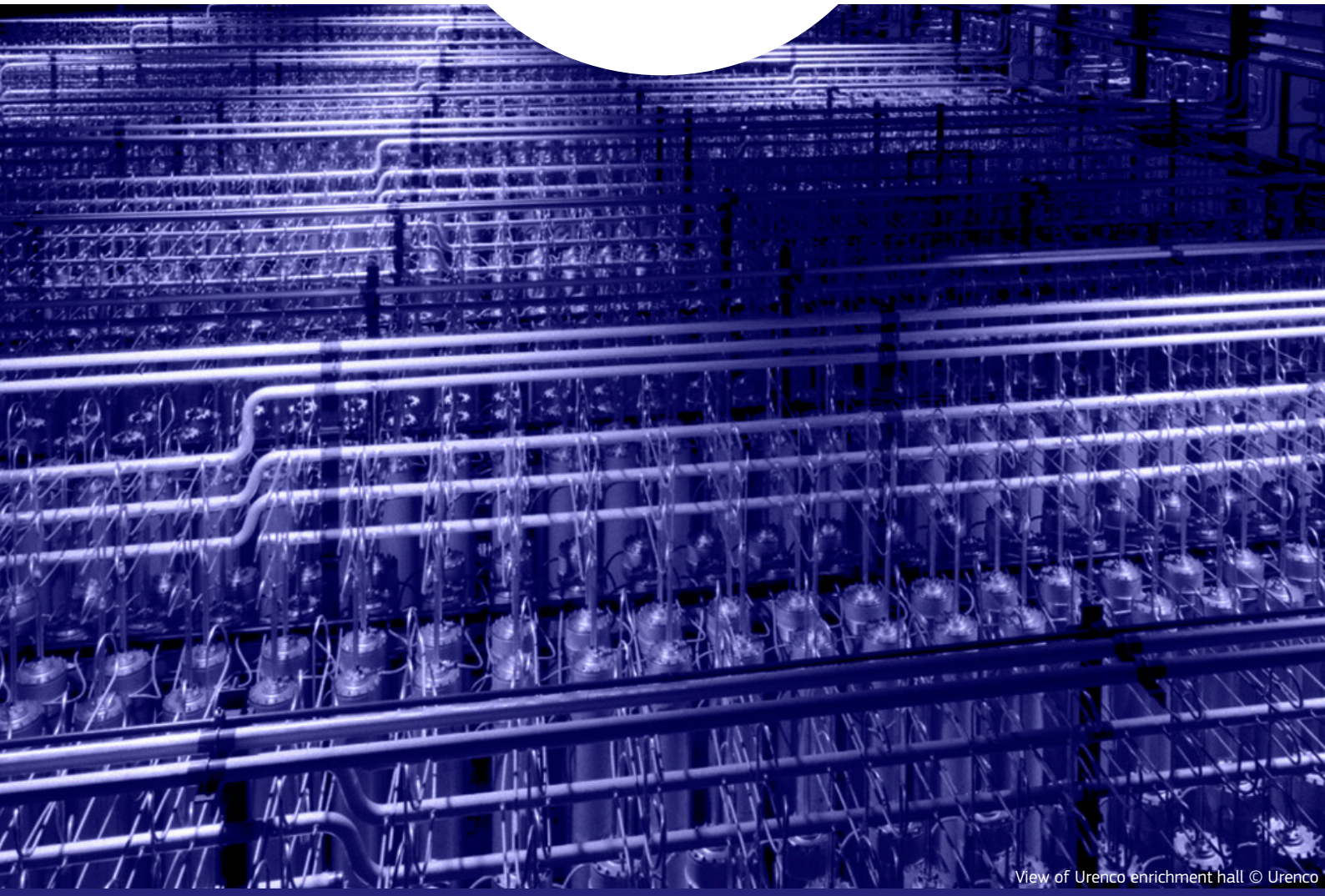


View of Urenco enrichment hall © Urenco

Quarterly Uranium Market Report

3rd Quarter 2021 4th Quarter 2021

Prepared by
Dariusz KOZAK, Niina PALOMÄKI, Marcel REHAK

Contact
Nuclear-Observatory@ec.europa.eu

Disclaimer: This is an information tool based on selected articles from the press. It does not necessarily reflect the editors' views and does not constitute any formal commitment on behalf of the Euratom Supply Agency or the European Commission.

International and EU developments

The Euratom Supply Agency (ESA) published its 2020 Annual Report offering an updated view of the nuclear fuel supply market. While 2020 marked 60 years of ESA operations, the market was significantly impacted by the COVID-19 pandemic that caused disruptions of uranium production and related services.

The European Commission adopted the EUR 300 million Euratom Work Programme 2021-2022, implementing the Euratom Research and Training Programme 2021-2025, complementing Horizon Europe.

International Atomic Energy Agency (IAEA) calls for more Member States to appoint a national focal point on denials of shipment of radioactive materials, striving for easier transport of these materials.

The European Space Agency contracted Belgian Tractebel to explore the possibility of plutonium-238 production for use in space exploration.

US Defense Advanced Research Projects Agency contracted X-energy to develop key fuel fabrication processes in support of a first-of-a-kind rocket powered by nuclear thermal propulsion.

The World Nuclear Association (WNA) published its annual Performance Report 2021, noting that nuclear reactors supplied slightly less electricity globally in 2020 than in 2019. The decrease occurred due to the COVID-19 pandemic and the need for nuclear to provide a load-following support to variable renewable generation sources.

WNA published Nuclear Fuel Report 2021-2040 predicting world nuclear generating capacity to continue its upward trend. Uranium fuel demand should increase – although the uranium resources are more than sufficient, intense development of new projects will be needed to avoid potential supply disruptions.

IAEA published its 41st Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 projecting a 10% rise under its high case, for the first time since the Fukushima disaster in 2011. IAEA attributed its higher projections due to a number of countries considering the nuclear energy to support low-carbon and baseload energy production. In the high case scenario the world nuclear generating capacity should double to 792 GWe by 2050, up from 393 GWe in 2020.

The European Union and the IAEA extended 2013 agreement on cooperation on nuclear safety. The agreement already resulted in one hundred nuclear safety review missions, environmental remediation at former uranium sites in Central Asia and more effective radioactive waste management in Africa.

IAEA released 'Nuclear Energy for a Net Zero World' report stressing the importance of nuclear power in order to achieve the goals of the Paris Agreement and Agenda 2030 for Sustainable Development. The report not only discusses the nuclear cuts emissions in the electricity sector, it also underlines its contribution to the employment on a global scale. The economic impact generated by nuclear investments is also stressed. The U.S. Energy Information Administration (EIA) published its International Energy Outlook 2021 predicting a 15% increase in worldwide nuclear generation by 2050.

Global Hydrogen Review 2021, report published by International Energy Agency (IEA) counts on nuclear power in coming global hydrogen boom, to produce hydrogen from water using electrolysis.

The World Energy Outlook 2021 report published by IEA tends to confirm the importance of nuclear energy as part of net zero strategy.Several nuclear industry groups jointly published a report "Nuclear's Contribution to Achieving the UN Sustainable Development Goals".

The United Nations Economic Commission for Europe published a report titled "Life Cycle Assessment of Electricity Generation Options" assessing the lifecycle environmental impacts of different electricity generation options. The report concludes that nuclear power produces less carbon emissions over its entire lifecycle than any other electricity generation source.

A group of more than 100 Members of the European Parliament appealed to the European Commission in a letter, for an inclusion of nuclear power under the Sustainable Finance Taxonomy (Taxonomy), calling for its recognition as a "green" energy technology.

The Commissioner for Energy Kadri Simson called for inclusion of nuclear power in Taxonomy, in a speech to the European Parliament.

The European Commission President Ursula von der Leyen expressed herself about nuclear energy when she said it is needed as a "stable source of energy" and should be included in the Taxonomy. Nuclear power in Taxonomy – the source of disagreement among EU governments - would benefit from more favourable EU and private funding for development of and investment in new power plants.

On 31 December 2021 the Commission shared with the Member States Expert Group on sustainable finance and with the Platform on Sustainable Finance the draft Complementary Delegated Act which sets out clear conditions under which certain natural gas and nuclear energy activities can, for a defined period, qualify as environmentally sustainable.

A 2021 update of the study "Pathways to 2050: Role of nuclear in a low-carbon Europe" commissioned for FORATOM tends to reinforce the role of nuclear power in the EU's low-carbon energy system. A system based on variable renewables will require the backup of additional flexible capacity - nuclear is the only dispatchable, low-carbon and non-weather dependent technology to serve this purpose.

The International Atomic Energy Agency announced the installation of new surveillance cameras at Iran's Karaj centrifuge component manufacturing workshop under a mutual agreement of IAEA and Iran.

Developments in the Member States

BELGIUM:

Belgian grid operator Elia published a vision report "Roadmap to net zero" calling for investments in new power interconnectors with the UK and Netherlands to ensure sufficient electricity after the shutdown of Belgian NPPs. The plants are supposed to be replaced by renewables and natural gas, however these would not suffice to supply the electricity to Belgium.

BULGARIA:

During his visit to Bulgaria, the European Commission Vice President Timmermans expressed support to restart Belene NPP project in Bulgaria. Bulgaria relies on coal power with plans to continue to do that until 2040. The EU support for low-carbon nuclear could be the easiest way to decarbonize Bulgaria's power sector.

US company Fluor signed a Memorandum of Understanding with Bulgarian Energy Holding EAD to consider the possibility of constructing new nuclear units in Bulgaria.

CROATIA:

Croatia informed of its interest in co-funding construction of Unit 2 at the Krško Nuclear Power Plant (NPP), should Slovenia decide to carry out its construction. Slovenia already issued an energy permit for the proposed Unit 2.

CZECHIA:

Czechia approved so-called "Dukovany law" (in force as of 1.1.2022), setting out a framework for the government to offer guaranteed prices for electricity produced from new reactors, thus financing the project. The law also excludes Russian and Chinese companies from participating in the construction of new reactors. The nuclear power in the country has also support of the new Czech government committed to construction of new Dukovany unit as well as research and development of small modular reactors. The government should also decide, during its ongoing term, whether one or two new nuclear plants should be constructed at CEZ's Temelin plant.

IEA published a review of Czech energy policies calling for "better use of the various low-carbon energy sources that can help it transition in a secure way to a cleaner energy system and power its economy for decades to come". The IEA recommends continued support to CEZ in the tender process for a new reactor at the Dukovany nuclear power plant, and calls for the Czech government to identify the role for small modular reactors with emphasis on the industrial and district heating sectors.

Czech utility CEZ informed about growing interest in clean electricity among large companies, in connection with meeting European climate commitments.

IAEA performed a nuclear security advisory mission in the Czechia aimed at review of the legislative and regulatory framework for the physical protection of nuclear material and associated facilities and activities, including transport, concluding with positive result.

FINLAND:

Fennovoima reported the start of construction of the first permanent structure - first foundation slab of caissons of culvert at the standby seawater channel - at Hanhikivi 1 site. The project for construction of a VVER-1200 with Russia's Rosatom received attention from Finnish Defence Ministry, who demanded that the risk assessment at the Hanhikivi plant be carried out. The Ministry warned that project is sensitive from geopolitical, economic and fuel supply point of view due to Rosatom`s 34% share.

Finnish government is preparing a reform of the Nuclear Energy Act in order to bring it up-to-date with the latest technologies and knowledge, incl. small modular reactors.

TVO`s Olkiluoto unit 3 received a start-up permission. After the low-power testing and connection to the grid, electricity production was scheduled to begin at the end of January and commercial production in June 2022.

FRANCE:

France launched a EUR75 million call for projects for innovation in radioactive waste management.

France decided to postpone planned restructuring of EDF, also called Projet Hercules or Grand EDF. The French government has not reached a final EDF restructuring agreement with the EU and also faces opposition in France.

France 2030 – an investment plan for re-industrialisation was published. The first objective of a 10-objective plan is a development of small modular reactors with a better management of nuclear waste.

EDF and French state launched a fund "Fonds France Nucléaire" dedicated to support small and medium enterprises in the nuclear sector, with EUR 200 million by 2023.

Support for nuclear energy in France is growing, according to a survey conducted by BVA on behalf of ORANO. Amongst others, the survey revealed that 53% of French consider nuclear energy essential for the country's energy independence.

French President announced a decision to build new nuclear reactors in France to decrease French dependence on foreign energy supplies, meet global warming targets and keep prices under control.

EDF shut down reactors at Civaux 1 and 2 after the defective welds were discovered on the pipes of the safety injection system in the primary cooling system. EDF also shut two reactors at Chooz B to inspect similar welds in the primary circuit. The corrosion defects were discovered during ultrasonic testing as part of the units' decennial periodic safety review.

GERMANY:

After the shutdown of Gundremmingen-C, Brokdorf Grohnde NPPs, German nuclear phase-out should be completed in 2022 with the shutdown of remaining reactors at Neckar-2, Isar-2, and Emsland.

Orano signed contracts worth than EUR 1 billion with German EnBW, PreussenElektra, RWE and Vattenfall to return the radioactive waste from reprocessing during 1977-1991 and remaining at Orano`s La Hague reprocessing plant. The waste is to be returned to Germany by 2024.

Vattenfall ended the dispute with German government after it received final compensation of EUR 1.4 billion for early shutdown of Krummel reactor.

RWE contracted Westinghouse for dismantling of two reactors at the Gundremmingen NPP and a consortium of Framatome and Transnubel for dismantling of the Emsland NPP.

HUNGARY:

Hungarian government informed about expected start of construction of Paks II NPP in 2022 and start of operation in 2028-2029.

Hungary (and Poland) signed a nuclear cooperation agreement with South Korea in a meeting of Visegrad Group with South Korea in November 2021.

NETHERLANDS:

The Dutch government decided to strongly support nuclear energy placing it at the centre of its climate and energy policy. Approximately EUR 500 million is dedicated up to 2025 to support new nuclear build with more funding planned to follow gradually until 2030 and the lifetime of Borssele NPP is therefore also planned to be extended beyond scheduled 2033.

POLAND:

Poland agreed with U.S. Westinghouse to launch a Front-End Engineering and Design work under a grant from the U.S. Trade and Development Agency, thus realising one of the key elements of the Intergovernmental Agreement between Poland and the United States on a civil nuclear power program.

Polish oil and gas producer PKN ORLEN signed a Nuclear Cooperation Agreement and launched a joint venture with Polish chemicals and industrials firm Synthos to pursue development and implementation of micro and small modular reactors. Synthos also signed an agreement with ZE PAK to explore a possibility of building an SMR (Small Modular Reactor) at ZE PAK`s Patnow coal plant. Moreover, Synthos signed a Memorandum of Understanding with Cameco, GE Hitachi Nuclear Energy and GEH SMR Technologies Canada Ltd to evaluate a potential Canadian supply chain for a fleet of BWRX-300 reactors in Poland.

Polish companies KGHM Polska Miedź SA and Piela Business Engineering came into an agreement with NuScale Power to explore the deployment of NuScale's SMR technology at existing coal-fired power plants in Poland.

Polish government informed it is looking for investors for 49% share in its new nuclear projects. Poland plans to build up to 9 GW of capacity by 2043.

EDF submitted to Poland an offer for construction of four to six EPR nuclear reactors with an installed capacity of up to 9.9 GW.

ROMANIA:

Romania and Canada signed a Memorandum of Understanding to strengthen cooperation on nuclear energy and work closely on CERNAVODA NPP modernisation.

Nuclearelectrica set up a uranium concentrate processing branch - Uranium Concentrate Processing Factory-Feldioara - for processing of nuclear fuels.

The Romanian government adopted an integrated energy plan envisaging two new CANDU reactors at Cernavoda by 2031 and the modernisation of an existing unit by 2037.

Nuclearelectrica signed an agreement with NuScale for cooperation on SMR and their deployment in Romania. The companies already signed a Memorandum of Understanding to this end, in 2019.

SLOVAKIA:

Slovak parliament decided to forbid processing of radioactive waste or spent fuel from other countries in Slovakia. These services are provided by JAVYS, company in charge of RAW management and decommissioning.

Slovakia decided to suspend for two years the payments into the nuclear decommissioning fund. The decision should help alleviate high electricity prices. Payments to the fund should resume in 2024.

SLOVENIA:

Slovenian government issued the energy permit for the planned Krško 2 unit. The permit is only a first step in the process to possibly build a new unit at Krško NPP - national spatial plan, environmental impact assessment, cross-border impact assessment, building permit issuance, vendor selection, financing terms etc. are to follow. Consequently, Slovenian Minister of the Environment and Spatial Planning called for the nationwide referendum, whether to build this new reactor.

SPAIN:

Spanish Nuclear Safety Council decided to block the Salamanca uranium concentrate plant project of Berkeley Energia due to lack of reliability and a high level of uncertainty on how radioactive waste would be stored at the facility.

Ascó NPP units 1 and 2 received the operating license extension by 9 years (to 2030) and 10 years (to 2031), respectively.

Enusa Industrias Avanzadas and IAEA signed a collaboration agreement to work on environmental protection and rehabilitation after the decommissioning of nuclear facilities, waste management and transport of nuclear and radioactive materials.

SWEDEN:

The Swedish government approved SKB's application to extend the final repository for short-lived radioactive waste (SFR) in Forsmark. The facility needs to be extended to accommodate decommissioning waste from Swedish nuclear power plants. The decision

concerning SKB`s application for a licence to build a final repository for spent nuclear fuel in Forsmark and an encapsulation plant in Oskarshamn is expected on 27 January 2022.

...and worldwide

ARGENTINA:

Argentina plans to increase its nuclear fleet with the help of China and Canada. The plans are for Hualong One and CANDU reactors.

ARMENIA:

Rosatom informed it completed the life extension and modernization program for the Metzamor NPP unit 2 in Armenia, which is currently to operate until 2026.

BELARUS:

The European Nuclear Safety Regulators Group (ENSREG) performed its second review at Belarus' Ostrovets nuclear power plant. According to ENSREG the review went through "in a positive and open way in which the Belarusian Nuclear Regulatory authority (GAN) and the licensee sought to address all the comments and questions". The international team "recognized that progress in the implementation of the Belarusian National Action Plan has been significant and faster than announced in the original plan" and GAN is encouraged to continue implementing remaining actions from 2018 Report. Some areas where further safety enhancement could be achieved were identified.

Ostravets-1 was reconnected to the grid after an outage following an automatic shutdown in July and Ostravets-2 completed hot testing, expected to enter operation later during the year.

Operational Safety Review Team (OSART) assembled by IAEA "observed significant improvements" in operational practices at Ostrovets NPP. The IAEA also arranged for an Integrated Regulatory Review Service at Ostrovets to see implementation of 2016 recommendations and suggestions noting that "Belarus has made considerable improvements in its regulatory framework for safety since the 2016 mission and shows a strong commitment to nuclear and radiation safety".

Ostrovets was also a place of separate reviews for experts via the World Association of Nuclear Operators (WANO), and the Western European Nuclear Regulators Association (WENRA).

BRAZIL:

Brazil created a state-run company ENBpar that will hold certain assets of company Eletrobras, that is up for privatisation. ENBpar will take over from Eletrobras the Itaipu hydroelectric power plant and the Angra nuclear power plant before Eletrobras is privatised.

CANADA:

Westinghouse and Bruce Power commissioned a feasibility report on the role Westinghouse`s eVinci microreactor. The microreactor is to supply off-grid electricity at decentralized locations in Canada such as mines and remote communities. The study concludes that the microreactor is 14% to 44% more economic than diesel generator and could reduce carbon emmissions by 90%.

NuScale signed a Memorandum of Understanding with Canadian marine nuclear power station developer Prodigy Clean Energy and a company Kinectrics Incorporated to explore regulatory framework for a Prodigy Marine Power Station that would integrate up to 12 NuScale SMRs.

CHINA:

China started a construction of the ACP100 demonstration small modular reactor (125 MWe pressurised water reactor) at the Changjiang NPP.

China Huaneng Group (CHG) informed that the two units of the High Temperature Gas-cooled Reactor Demonstration Project (HTR-PM) achieved initial criticality and are in the power operation phase.

China National Nuclear Corp. (CNNC) informed that Unit 6 of the Fuqing NPP (HPR-1000 - Hualong One) achieved initial criticality.

EGYPT:

The Egyptian Nuclear Power Plant Authority applied for permits to construct units 1&2 and 3&4 of El Dabaa NPP.

INDIA:

First concrete was poured for Unit 5 of the Kudankulam NPP in India marking the official start of the construction of units 5&6 at this NPP.

JAPAN:

Japanes Oarai high-temperature test reactor resumed operation after nearly 11 years due to new, stricter post-Fukushima safety standards.

Tokyo Electric Power Company informed that according to the standardised radiological impact assessment, water released from Fukushima will have minimal impact on the public and the environment.

JORDAN:

Jordanian Uranium Mining Company announced that it has been operating a “pioneering” processing plant to recover yellowcake from uranium ores over the course of 2021.

KAZAKHSTAN:

NuScale Power and Kazakh Nuclear Power Plants LLP signed a memorandum of understanding to assess deployment of small modular reactors in Kazakhstan.

NORWAY:

U.S. Department of Energy (DOE) and Norway’s Ministry of Trade, Industry, and Fisheries agreed via a Memorandum of Understanding (MOU) to eliminate all of Norway’s highly enriched uranium (HEU) by downblending it to low-enriched uranium (LEU).

RUSSIA:

Rosatom informed that Polish ZE PAK expressed interest in its project to complete the nuclear power plant in Kaliningrad.

Rosatom plans to supply four floating NPPs (55 MWe RITM-200M reactors) to the new Baimskaya copper mining project in Russia. The deal is expected to be concluded by April 2022.

Rosatom plans to build 10 large reactors in Russia by 2035 and another two more units each year in the years to come to replace aging nuclear units.

Rosatom informed about two of its projects - it plans to complete the technical design of its 10 MW Shelf M microreactor by the end of 2024 and its RITM-200N - the land-based version the floating reactor – is expected be deployed in Yakutia, in 2028.

Rosatom, EDF and the French Alternative Energies and Atomic Energy Commission (CEA) signed a declaration of intent to work on commercial nuclear research and deployment, targeting mixed oxide fuel reprocessing.

SERBIA:

Serbia and Rosatom signed a framework agreement to build a nuclear technology centre in the country, including a cyclotron for medical isotope production.

Serbia's President informed that the country is interested in buying a 10% share in any nuclear power plant in the region to enhance country`s energy supply security. As Serbia does not have means to build its own NPP it would consider one of the four projects in the region, including Krško 2 in Slovenia, Paks-II in Hungary, Kozloduy in Bulgaria, and Cernavoda 3 & 4 in Romania.

SOUTH-AFRICA:

South Africa plans to issue a Request for Proposals (RFP) for new reactors with a combined capacity of 2,500 MWe by March 2022, hoping to select a supplier before the end of 2024.

The South African cabinet approved the construction of the Multipurpose Reactor succeeding its Safari-1 research reactor.

SWITZERLAND:

Three Swiss regions shortlisted for the siting of a deep geologic repository for radioactive waste submitted a request for at least CHF800 million in compensation (still to be the subject of negotiations between the Swiss national government and the host communities).

Leibstadt NPP was reconnected to the grid after a six-month outage.

TURKEY:

Rosatom started excavation works at unit 4 of Akkuyu NPP in Turkey. All the units of Akkuyu NPP are being built simultaneously and expected to be finished in mid 2020s.

UKRAINE:

The first storage module of the ISF-2 dry storage facility at the Chernobyl NPP has been filled with used fuel and sealed by the International Atomic Energy Agency.

Energoatom and Westinghouse agreed to work together on development of several AP1000 reactors in Ukraine and signed contract for first AP1000 at Khmelnitsky NPP.

After Energoatom implemented a large-scale project at its Zaporozhe NPP, the plant started operating at its full capacity of 6040 MWe for the first time in its history.

UNITED ARAB EMIRATES:

Emirates Nuclear Energy Corporation (ENEC) informed about completion of construction of Unit 3 of the Barakah NPP. The unit is expected to start operation in 2023.

UNITED KINGDOM:

EDF Energy informed that Heysham B and Torness NPP will be shut down on 31 March 2028 at the latest. The units`shutdown was advanced by 2 years due to increased cost of inspections related to graphite cracking.

The UK government published its "Net Zero Strategy" that includes a newly announced Future Nuclear Enabling Fund providing £120 million for nuclear projects development.

Rolls-Royce SMR Ltd. submitted its UK SMR design for an initial screening, to decide whether it can formally enter the Office of Nuclear Regulation's (ONR) full GDA process.

Unit 1 of the Hunterston B NPP was shut down in November after 46 years of operation. The unit 2 would be shut down in January 2022.

USA:

Energy Harbor and the U.S. DOE agreed to develop a project at the Davis-Besse NPP to demonstrate zero-carbon hydrogen production by Low Temperature Electrolysis, to see whether this could be scaled up to a commercial level.

The new Infrastructure Investment and Jobs Act includes USD 17 billion for the US Department of Energy for nuclear energy and hydrogen programs over several years.

The US Department of Energy and Framatome agreed a USD 150 million, four-year cooperation for the development of PROtect accident tolerant fuel technology.

Uranium production

In July, Kazatomprom announced that it plans to maintain 2023 Kazakh production at a similar level to 2022, which is expected to be 20% lower than the planned volumes under Subsoil Use Contracts. The company said it will now begin working with its partners to assess the impact and implement the updated production plan across all of Kazakhstan's uranium mines.

In July , a month-long public consultation period began in Greenland for a proposed bill that, in addition to implementing an outright ban on uranium mining, would also forbid the feasibility studies and exploration activities that must be completed before applying for mining operation license.

In July, Berkeley Energia Ltd. announced July 23 that it intends to abolish unfavourable decision by the Spanish government's Nuclear Safety Council (NSC) for the grant of the Authorisation for Construction for the uranium concentrate plant as a radioactive facility (NSC II) at the company's Salamanca project. The company submitted an "Improvement Report" to supplement its initial NSC II Application, requested the NSC to reassess the application. Berkeley believes that the project is compliant with all NSC's requirements.

In August, the U.S. DOE published a request for information (RFI) in which it seeks a public input on the establishment of a domestically sourced uranium reserve. Congress allocated USD 75 million in budgetary appropriations to establish the reserve. DOE said in the RFI that the US nuclear industry and the nuclear fuel supply chain "face significant challenges that have left domestic nuclear fuel suppliers in a weakened position on the domestic and global stage". The department expects the acquisition of U3O8 to result in new uranium production at existing US production sites,

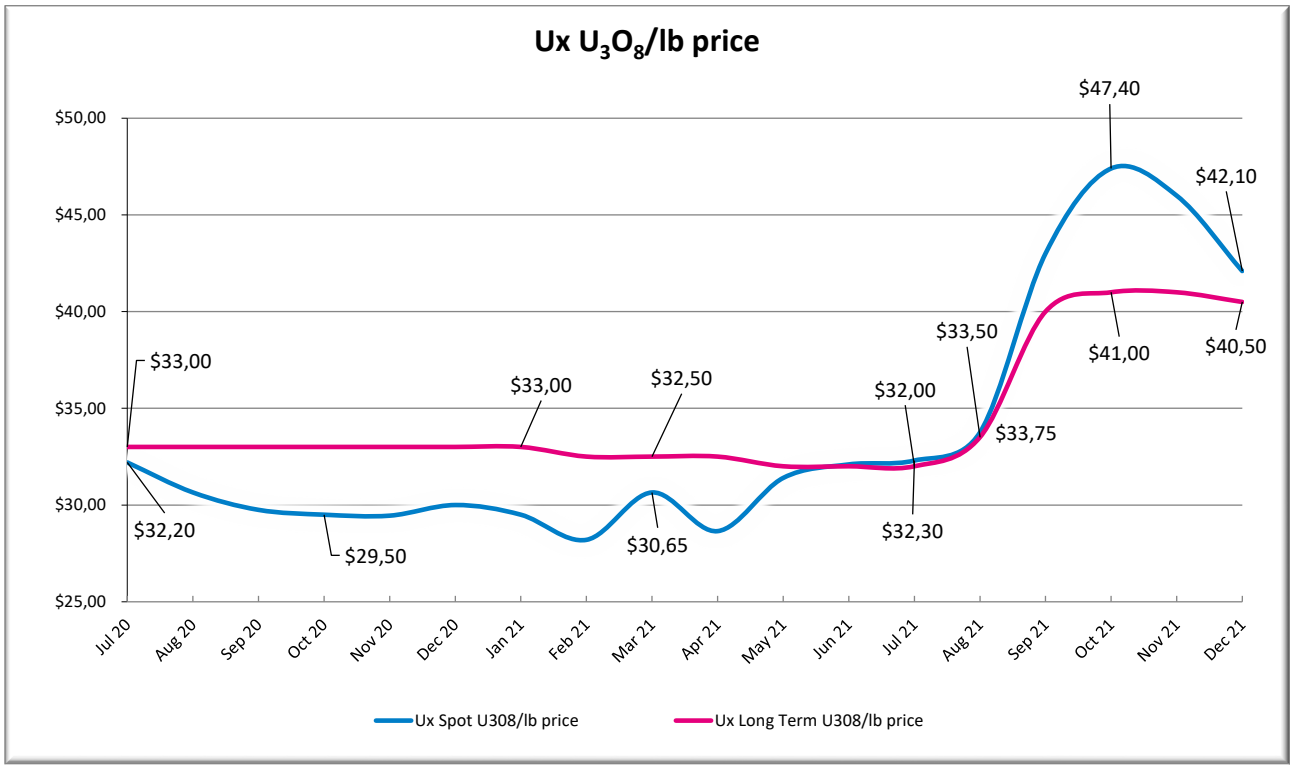
In September, Kayelekera project was granted by the Government of Malawi renewed mining and exploration licences for 15 years. Kayelekera has been under care-and-maintenance since 2014.

Uranium prices[1]

The UX monthly spot uranium price decreased by more than 2% comparing quarter to quarter and, at the end of December, it accounted for USD 42.10/lb U3O8. It was up by more than 40% in an annual comparison.

The UX long term uranium price accounted for USD 40.50/lb U3O8 at the end of December, which is more than 1% up when compared quarter to quarter and more than 22% up in an annual comparison.

Panellists at the World Nuclear Association Annual Symposium 2021, which was held in September, agreed together, that activity on the spot market was driven by many uranium market players in 2020 and 2021, when mining companies responded to the COVID pandemic and decreased their mining output. According to panellists, over the past two years we have seen an increased diversity of buyers on the spot market, with some suppliers and financial players entering market in addition to the traditional utilities and traders, which in result increased the demand of natural uranium. There has been an increasing trend of funds participating in the market over the recent years and we saw increased volatility in third quarter of 2021, which led to an increase in the natural uranium prices. In the long run this may lead to a true equilibrium to what the uranium price should be, based on actual costs of production.



Romanian uranium producer Compania Națională a Uraniului terminated mining operations at Crucea-Botușana mine.

Kazatomprom saw its uranium output increased in the Q3 2021 by 18% to 5,508 mtU compared to 2020. Overall output for the first three quarters also increased 6% to 15,960 mtU, compared to the first three quarters of 2020. However uranium sales volume in the first three quarters of 2021 were lower than in 2020. This was "due to the timing of customer requirements and differences in the timing of deliveries in 2020 and 2021".

Greenland passed law banning uranium mining and exploration in the Danish territory.

1 *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.*

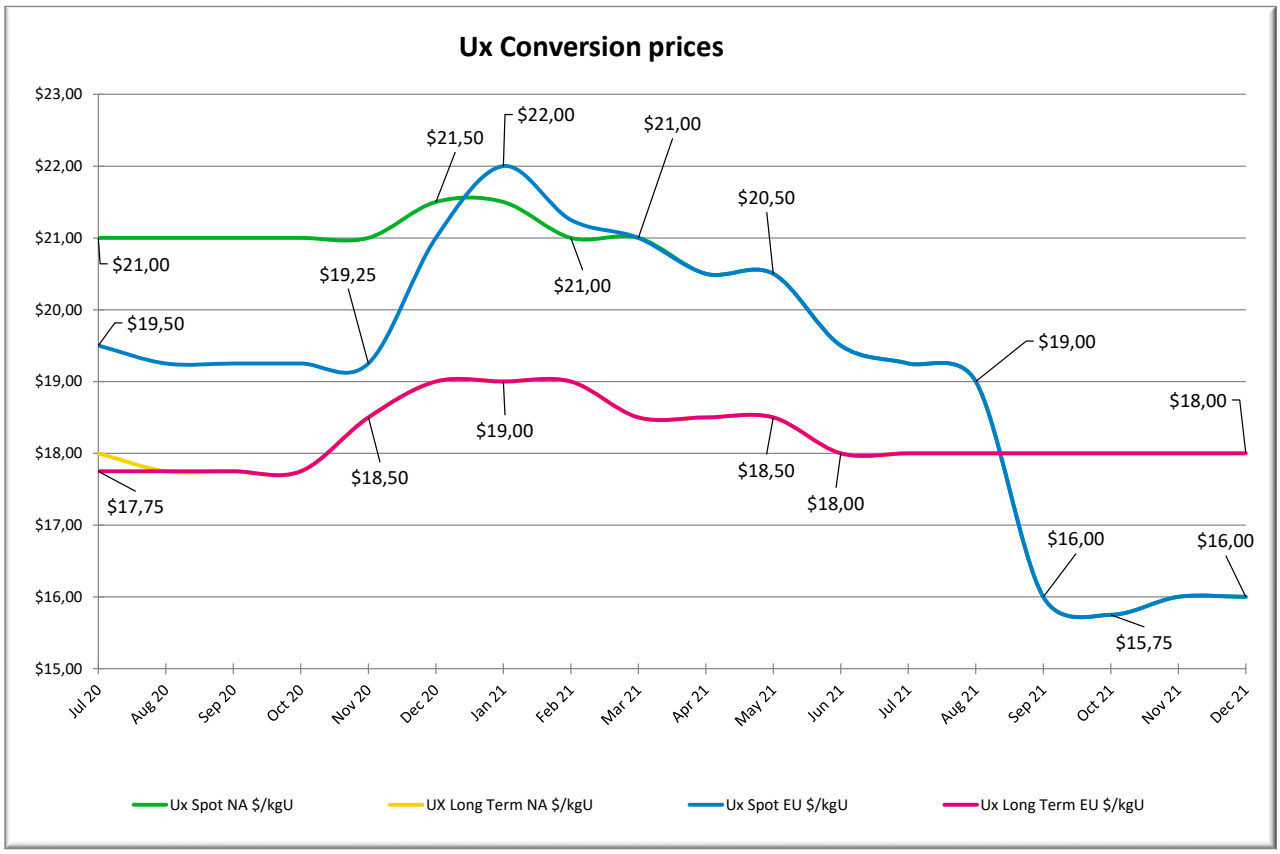
Kazatomprom signed two long-term uranium supply contracts with two Chinese nuclear companies: China National Uranium Co., and State Nuclear Uranium Resources Development Co.

Vimy Resources Ltd. informed it received approval for its operational radiation management plan and began development of the Mulga Rock uranium project in Western Australia.

Conversion

Spot conversion price in the European Union did not change and in North America increased by 13% compared to the previous quarter and amounted to USD 16.00/kg in the EU and 18.00/kg in North America at the end of December. In an annual comparison, they decreased by 24% in the European Union and by 16% in North America.

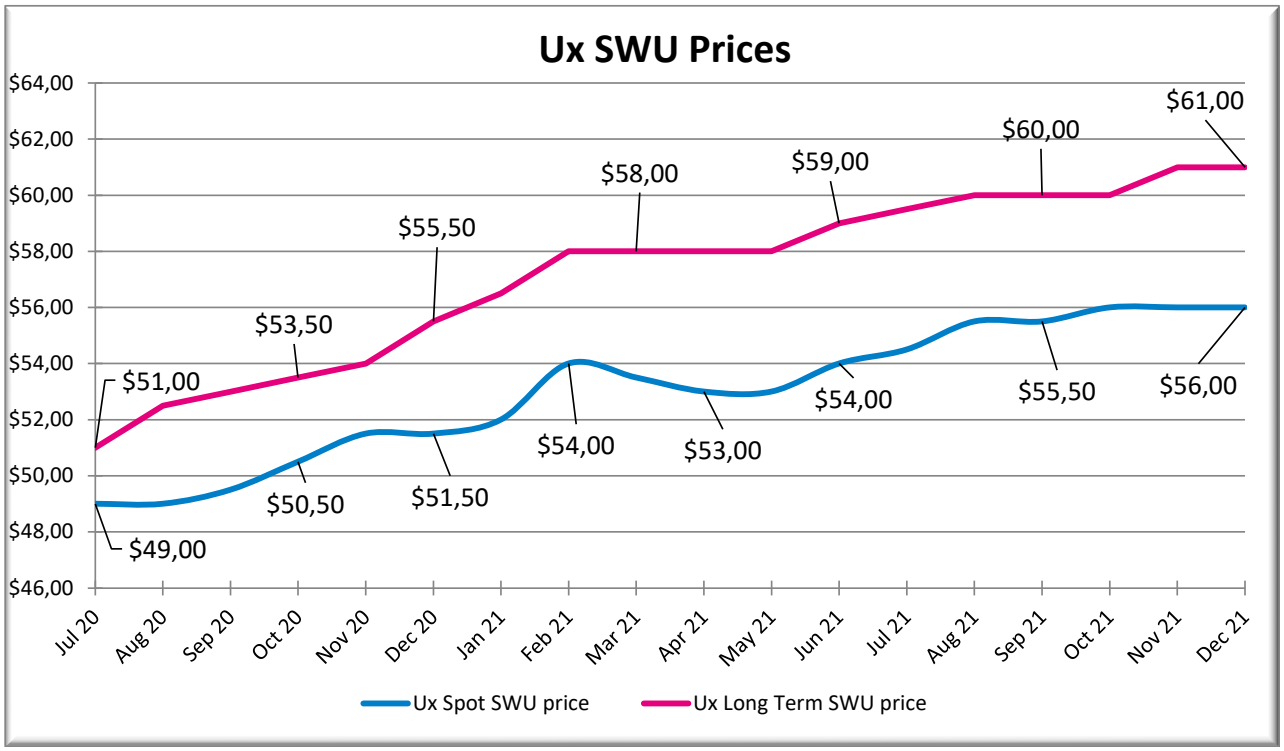
UX long term conversion prices amounted to USD 16.00/kg in the EU and 18.00/kg in North America at the end of December, which means decrease by 11% in the European Union and no change in North America, when compared to the previous quarter. They decreased by 16% in the European Union and by 5% in North America in an annual comparison.



Enrichment

At the end of December 2021, the UX spot SWU price amounted to USD 56.00 per SWU and it increased by almost 1% compared to the previous quarter. It was up by almost 9% in an annual comparison.

The UX long term SWU price amounted to USD 61.00 and it increased by almost 2% compared to the previous quarter and by almost 10% compared to the same quarter of 2020.



Urenco approved the progression of the Urenco Metals Recycling facility in UK, planned to begin operation in 2024.

Russian TVEL informed that it commissioned the third cascade of new Generation 9+ centrifuges at JSC Electrochemical Plant (ECP) in Zelenogorsk.

Rosatom informed that EDF experts performed technical audit at Rosatom's Siberian Chemical Combine and confirmed that company fulfills all technical and environmental contractual requirements for the conversion and enrichment of reprocessed uranium as per contract between Rosatom and EDF.

The US DOE "Request for Information (RFI) Regarding Planning for Establishment of a Program To Support the Availability of High-Assay Low-Enriched Uranium (HALEU) for Civilian Domestic Research, Development, Demonstration, and Commercial Use". The program is necessary for the planned deployment of advanced reactors in the US, as HALEU is currently not commercially available from US suppliers. The goal of the program is to prevent reliance on Russia or other foreign suppliers.

Fuel fabrication

Framatome informed about a significant milestone concerning implementation of nuclear fuel at higher enrichments and burnups, as the U.S. Nuclear Regulatory Commission (NRC) accepted for review a topical report to apply Framatome`s Advanced Codes and Methods to operating conditions with 235U enrichments above the industry standard of 5 weight percent.

Westinghouse is increasing the presence in Ukraine. Energoatom informed that Rovno NPP received the first shipment of fuel assemblies from Westinghouse, replacing the fuel of TVEL.

TVEL informed it fabricated an experimental nuclear fuel assembly for 55MW RITM-200N SMR to be built in the Russian Yakutia.The first fuel assemblies will be manufactured in 2025, with the initial core expected in 2026.

Framatome delivered its accident tolerant fuel lead test assembly to Exelon Generation's Calvert Cliffs NPP in the US. The fuel should be more resistant to changes in reactor core temperatures, which increases coping time. Moreover, the new design aims to reduce corrosion and the production of hydrogen under high-temperature conditions.

Kazakh-Chinese joint venture fuel assembly plant opened in Kazakhstan at the Ulba Metallurgical Plant. The plant will use Framatome's fuel fabrication technology while using the already existing fuel pellet manufacturing capabilities, to supply fuel to China General Nuclear subsidiary CGNPC-URC.

TVEL informed that the first batch of its REMIX fuel (uranium-plutonium) for VVER-1000 PWRs was manufactured and passed acceptance testing at the Siberian Chemical Combine.

Centrus Energy and Oklo, Inc. signed a letter of intent to cooperate on deployment of a high-assay low-enriched uranium fuel production facility to help "establish domestic HALEU production capabilities to support the commercialization of Oklo's power plants" (1.5-MW fast neutron Aurora reactor, under licensing review by NRC).

Nuclear medicine

IBA (Ion Beam Applications S.A., EURONEXT) and SCK CEN (Belgian Nuclear Research Center) announced a strategic research partnership to enable the production of Actinimum-225.

More than 20 European academic institutions and research centres created a European medical isotope network – PRISMAP, to accelerate the introduction of new medical radioisotopes.

Urenco Stable Isotopes opened a new radioisotope cascade in Almelo, the Netherlands in response to growing demand for medical isotopes.

The Portuguese regulatory agency (INFARMED) granted the first EU marketing authorization to ICNAS/University of Coimbra to distribute [Ga-68]GaCl3 with a new process for producing Gallium-68 with an IBA cyclotron using a liquid target.

Orano informed it finished construction of a new laboratory for the production of stable isotopes at its Tricastin site. The laboratory will begin to operate in 2023.

The US National Nuclear Security Administration issued a USD 35 million cooperative agreement to SHINE Technologies to support the commercial production of molybdenum-99. The NNSA also awarded two agreements to NorthStar Medical Technologies and another one to Niowave.

Westinghouse Electric and EDF signed a Memorandum of Understanding to produce Cobalt-60 in selected pressurised water reactors owned and operated by EDF in France.

Concluded natural uranium contracts in the EU[2]

Quarter	ESA quarterly spot uranium price EUR/kgU	ESA quarterly spot uranium price USD/lb U_3O_8	ESA All Users quarterly spot uranium price EUR/kgU*	ESA All Users quarterly spot uranium price USD/lb U_3O_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***
2020 Q3	**-**	**-**	**64.52**	**29.26**	**3**	**5**	**79**
2020 Q4	**-**	**-**	**-**	**-**	**4**	**7**	**69**
2021 Q1	**-**	**-**	**-**	**-**	**3**	**8**	**67**
2021 Q2	**-**	**-**	**-**	**-**	**1**	**1**	**60**
2021 Q3	**-**	**-**	**-**	**-**	**2**	**4**	**61**
2021 Q4	**-**	**-**	**86,07******	**37,95******	**1**	**6**	**61**

* 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
**** price calculated for half year period

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)

2 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.