



# EURATOM Supply Agency

*Nuclear Fuel Market Observatory Sector*

- **Quarterly Uranium Market Report**  
**4<sup>th</sup> Quarter 2016**

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## International and EU developments

During a ceremony held in Brussels on 10 November 2016, Commissioner T. Navratscsics signed on behalf of Euratom the agreement providing for a ten-year extension of the Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems. The Generation IV International Forum (GIF) is a cooperative international endeavour, created to carry out research and development needed to establish the feasibility and performance capabilities of the next generation of nuclear energy systems.

On 17 November, the European Commission (EC) closed the infringement procedure it had launched against Hungary over public procurement rules in connection with Hungary's award of a contract to Russia's Rosatom for the construction of two new units at the Paks NPP. The EC concluded that the project does not infringe EU rules which allow public procurement without competition if the contract can only reasonably be given to one company, but it is still investigating whether there is state aid involved in the project.

On 30 November, the OECD Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA) released their biennially "Red Book", the *Uranium 2016: Resources, Production, and Demand*. This 26<sup>th</sup> edition of the Red Book provides a comprehensive assessment of the current uranium supply and demand projections to 2035 and contains extensive data on uranium resources, exploration, production, and uranium inventories.

The most significant changes compared with the previous edition can be found in the inferred resources category. Worldwide exploration and mine development spendings in 2014 showed a 10% increase over the 2012 total, with more than 38% of these exploration and development expenditures attributed to non-domestic activities, most notably China's (CGN) expenditure in the Husab mine in Namibia and France's (AREVA) expenditure in the Cigar Lake mine. From 2012 to 2014, domestic exploration and mine development spendings decreased due to lower uranium prices, with significant decreases reported from Argentina, Australia, Canada, Finland, Kazakhstan, Russia, South Africa, Spain, and the U.S. A total of 24 countries reported exploration and development drilling activities compared to 25 countries in the 2014 edition.

## Developments in the Member States

**CZECH REPUBLIC:** On 24 November, CEZ confirmed having initiated legal proceedings against the Czech nuclear engineering company and supplier Skoda JS, in order to recover damages for flawed checks of pipe welds done at the Temelin and Dukovany NPPs. The full extent of the damages required has not been determined yet.

**FRANCE:** End 2016, EDF declared that, by standardizing components and equipment, it is striving to reduce by 25% to 30% the current costs of the EPRs under construction. It seems that the number of product lines for pumps and cables at Flamanville-3, the company's EPR under construction in France, has affected the supply of those components and impacted the construction schedule. The EPR New Model, or EPR NM, would be the flagship model to replace the existing French nuclear fleet as older reactors reach the end of their operating lives. The first new reactors are expected to be available by 2030.

**GERMANY:** In a statement published on 6 December, Germany's Supreme Court acknowledged the country's 2011 nuclear phase-out law as constitutional. However, it also recognized that the rights of the nuclear power operators (E.ON, RWE and Vattenfall) had been partly infringed, and stated that the government should compensate the companies for their investments in the plants, based on Germany's post-2009 plan of extending reactor operating lifetimes by about 12 years. The new compensation rules must be in place by 30 June 2018.

**HUNGARY:** Hungary's National Atomic Energy Authority publicly announced end 2016 that, following a one-year review, it had granted the Paks-3 unit the permit to operate until 31 December 2036, an extension of 20 years beyond the reactor's original 30-year licence. No major conditions were imposed, apart from some additional inspections and repairs to be carried out in the near future, such as an enhanced monitoring of the unit's spent fuel pool; replacement of some coolant pump parts by 2018; and renovating larger pipes in the emergency cooling water system serving units 3 and 4. Paks currently meets almost 40% of Hungary's electricity demand, and accounts for more than 50% of domestic power generation. The company is preparing Paks-4 for a similar lifetime extension by the time its original license expires in 2017.

**SPAIN:** In November, Spain's nuclear regulator announced that it had approved a series of modifications to be performed at three NPPs (the 2,093-MW Almaraz, 1,066-MW Trillo and 1,092-MW Cofrente), as part of the EU-mandated post-Fukushima stress tests, conducted in 2012. The modifications include, among others, the installation of passive autocatalytic hydrogen recombiners, the construction of Emergency Management Centres on the three sites and a general revision of the existing emergency plans.

**SWEDEN:** In a statement released in November, OKG announced that, due to the earlier than planned closure of the 492-MW Oskarshamn-1 and the 661-MW Oskarshamn-2 reactors, in 2017 and 2018, respectively, more than a third of the company's workforce will be laid off between 2017 and the end of 2019. OKG estimates that neither unit can be profitably operated any longer.

## ... and worldwide

**INDIA:** On 11 November, India and Japan signed a bilateral nuclear cooperation agreement providing for the export of nuclear technology and reactors from Japan to India. Under the terms of the deal, Westinghouse and EDF will be able to export reactors to India, as there are certain components needed for U.S. and French reactors that are currently only manufactured in Japan. Japan has also agreed to continue supporting India's membership in the Nuclear Suppliers Group and other international export control regimes.

**JAPAN:** On 16 December, Japan and Russia signed a bilateral agreement providing for cooperation on civilian nuclear power issues, including the promotion of nuclear technology and the decommissioning of the Fukushima I NPP. The five-year agreement also includes the joint promotion of communications among private nuclear companies in the two countries.

**UKRAINE:** On 14 November, work started on the installation of a new confinement metal arch over the Chernobyl-4 reactor, destroyed in the 1986 accident. The construction, funded by the EBRD - administered Chernobyl Shelter Fund with contributions from 40 countries, will cost 1.5 billion Eur (\$1.62 billion) and is expected to last for at least 100 years. Built by a French consortium of Vinci Construction and Bouygues Construction, the arch has a total span of 257 meters (843 feet) and weighs 36,000 metric tons and, according to the EBRD, will provide increased safety in the event of an eventual dismantling of the aging shelter currently covering the reactor and the management of the radioactive waste within the structure.

## Uranium production

The Finnish state-owned management firm Terrafame Oy announced in November its intention to start processing uranium at the Sotkamo nickel mine in Finland. Previously owned by Talvivaara, which filed for bankruptcy in November 2014, the mine already has a uranium plant onsite, but actual uranium production still requires approval and environmental permits from regional authorities in Finland, and the European regulator, Euratom. Should uranium be produced at Sotkamo, Finland's requirements for its domestic nuclear power program would be almost entirely covered.

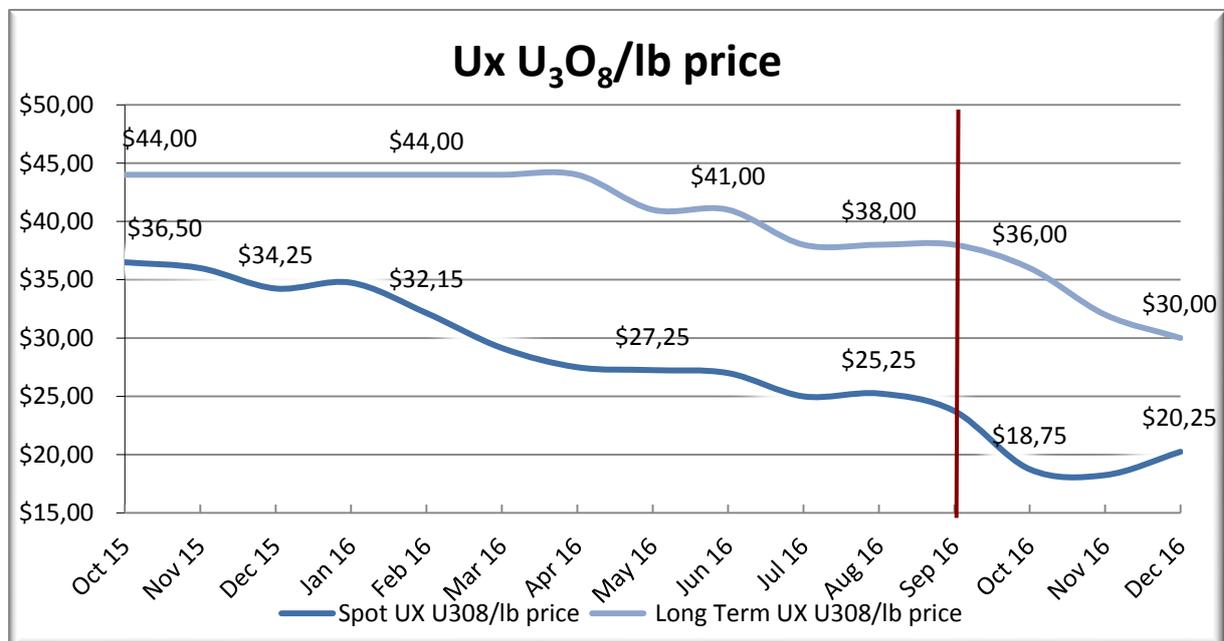
## Medical radioisotopes

In December, the U.S. company Exelon made public its plans to submit a licence amendment request to the NRC to allow reactors at its two-unit Byron plant in Illinois, or possibly at the two-unit Braidwood plant, to produce the medical isotope molybdenum-99. Mo-99 serves to the production of the technetium-99m isotope, used in about 40,000 medical procedures each day worldwide. Exelon hopes that NRC will approve the request by May 2017, so that small-scale testing production of the isotope could begin already in summer 2017. The project also requires the approval of the US Food and Drug Administration.

## Uranium prices

In the fourth quarter of 2016, the UX monthly spot uranium price fell by 15% comparing quarter to quarter and at the end of December it accounted for US\$20.25/lb U<sub>3</sub>O<sub>8</sub>. It was down by 51% compared with the fourth quarter of 2015.

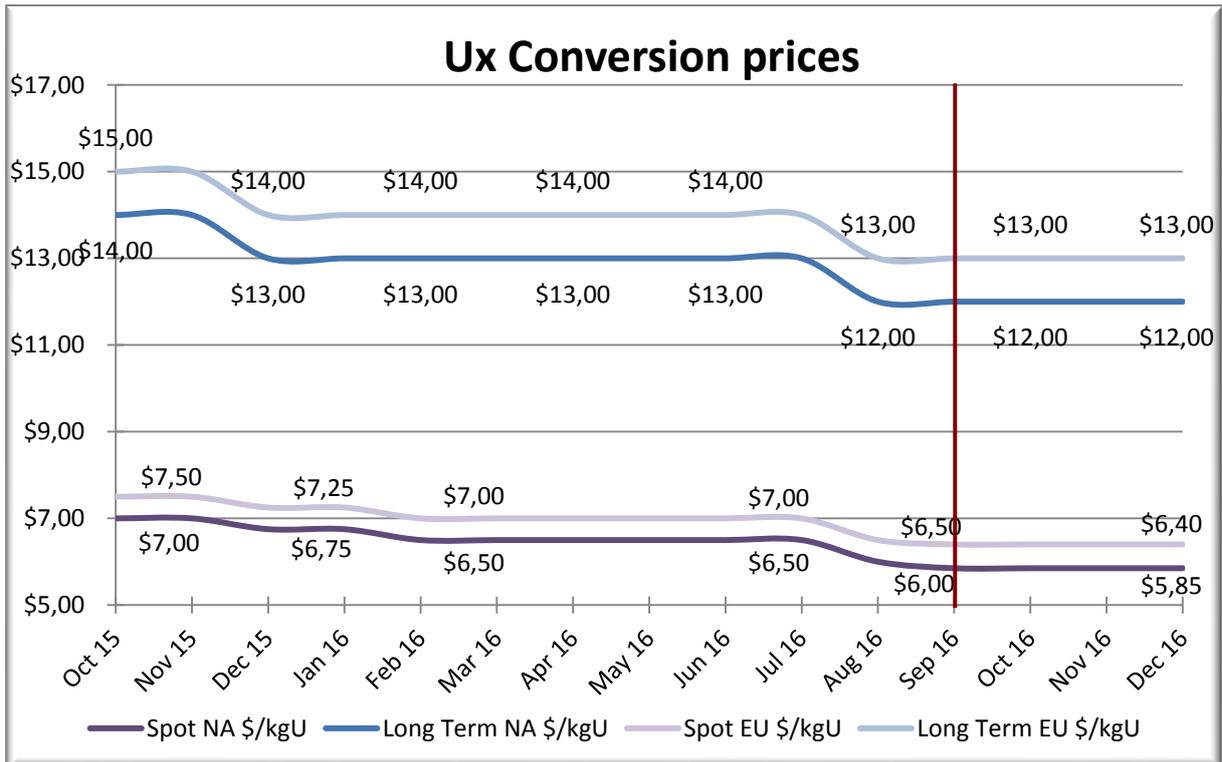
The UX long term uranium price for the fourth quarter of 2016 accounted for US\$30.00/lb U<sub>3</sub>O<sub>8</sub> at the end of December and it fell by 21% when compared quarter to quarter and by 32% comparing to the fourth quarter of 2015.



## Conversion

UX Spot conversion prices in the European Union and in North America did not change as compared with the third quarter of 2016 and amounted to US\$6.40/kg and US\$5.85/kg respectively. In an annual comparison they fell by 12% and 13% respectively.

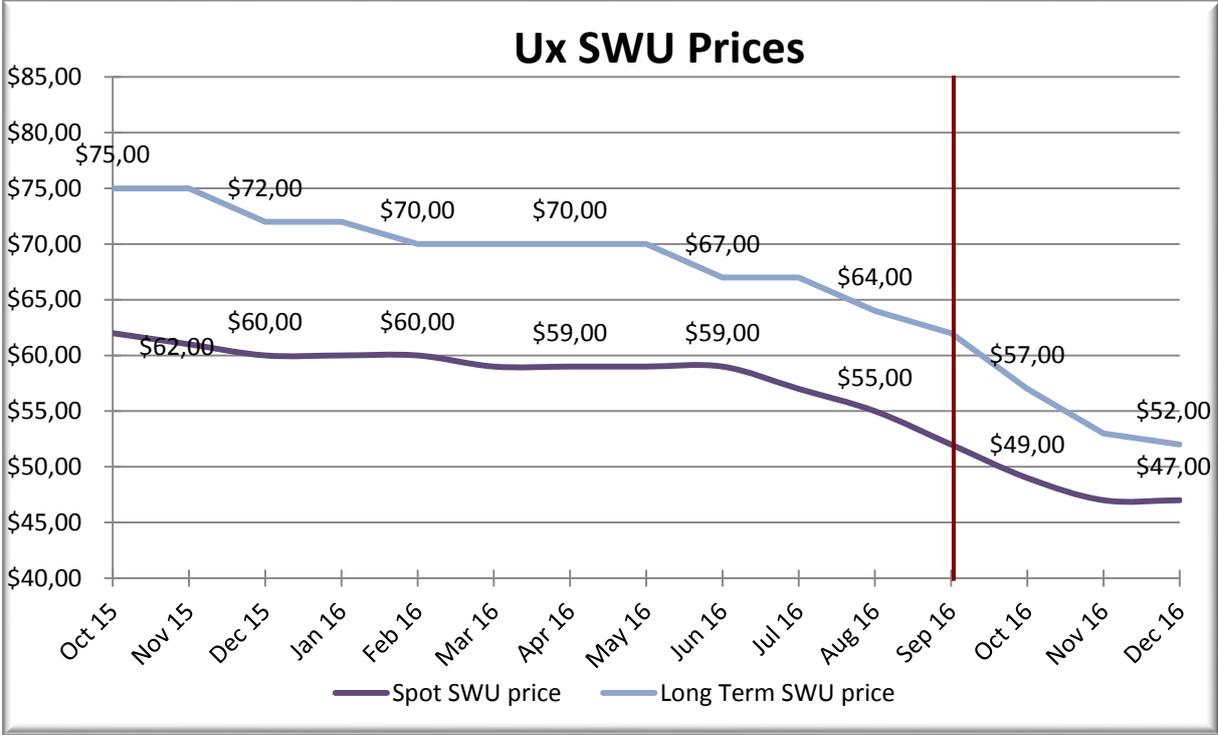
In the fourth quarter of 2016 UX long term conversion prices in the European Union and North America did not change when compared with the previous quarter and amounted to US\$13.00/kg in the EU and US\$12.00/kg in the US. They went down by 7% in the European Union and by 8% in North America comparing with the fourth quarter of 2015.



## Enrichment

At the end of December, the UX spot SWU price amounted to US\$47.00 per SWU and fell by almost 10% comparing with the previous quarter and it was down by almost 22% as compared with the fourth quarter of 2015.

The UX long term SWU price amounted to US\$52.00, which was about 16% down comparing with the previous quarter and 28% down on a yearly comparison.



## Fuel fabrication

NAC Kazatomprom and China General Nuclear Power Corp. (CGN) have reportedly started, end 2016, the construction of a fuel assembly (FA) fabrication facility in Kazakhstan, which will be managed through Ulba-FA, a joint venture between Kazatomprom's subsidiary Ulba Metallurgical Plant JSC (51%) and CGN's subsidiary, CGN-URC (49%). Under the terms of a contract signed with Ulba-FA, AREVA NP will be providing fuel assembly production technology, as well as engineering documentation, supply of key production equipment, and personnel training. Production, estimated at 200 tonnes of fuel assemblies per year, is expected to start in 2020. The FA manufacturing plant, seen as one of Kazatomprom's strategic steps towards production diversification, is expected to have a secure market outlet for at least 20 years.

In December, Rosatom announced that TVEL, its nuclear fuel subsidiary, had signed the first commercial contract for the supply, starting 2021, of its TVS-K fuel assemblies to Vattenfall, for use in the Ringhals plant in Sweden. One of the Ringhals units has already used TVS-K lead fuel assemblies during testing of the fuel under a contract signed in 2011. By signing this contract, Vattenfall enhances its diversification of nuclear fuel supply, at least for the 2018-2025 period, during which deliveries have been secured under long-term nuclear fuel supply contracts with three different suppliers.

## Concluded natural uranium contracts in the EU<sup>1</sup>

During the fourth quarter of 2016, ESA processed 118 transactions, including contracts, amendments and notifications on the front-end activities. Between October and December, the European utilities concluded 1 new spot natural uranium supply contract (including purchases, sales, exchanges and loans) and 5 new long term contracts.

| Quarter        | ESA quarterly spot uranium price EUR/kgU | Change in EUR | ESA quarterly spot uranium price USD/lb U <sub>3</sub> O <sub>8</sub> | Change in USD | Number of spot natural uranium contracts concluded by EU utilities (including purchases, sales, exchanges and loans) | Total number of contracts processed by ESA (including contracts, amendments and notifications on the front-end activities) |
|----------------|--|---------------|---|---------------|--|--|
| <b>2015 Q4</b> | <b>85.51</b>                             | -             | <b>36.02</b>  | -             | <b>6</b>   | <b>109</b>   |
| <b>2016 Q1</b> | -  | -             | -   | -             | <b>3</b>   | <b>70</b>  |
| <b>2016 Q2</b> | -  | -             | -   | -             | <b>0</b>   | <b>55</b>  |
| <b>2016 Q3</b> | -  | -             | -   | -             | <b>2</b>   | <b>101</b>   |
| <b>2016 Q4</b> | -  | -             | -   | -             | <b>1</b>   | <b>118</b>   |

The ESA publishes a spot price indicator on a quarterly basis, provided that there are at least three spot contracts concluded by the EU utilities (excluding exchanges and loans), and that the price indicated is fixed and not expressed as a formula.

### 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                       |
| PWR      | Pressurized Water Reactor                                  |
| ABWR     | Advanced Boiling Water Reactor                             |
| VVER     | Water-Water Power Reactor                                  |
| SWU      | Separative Work Unit                                       |
| tU       | tonne U (= 1 000 kg uranium)                               |

<sup>1</sup> 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.