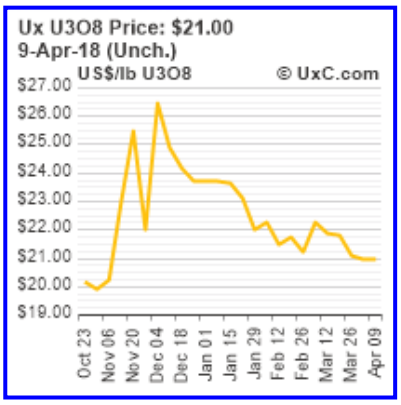
Uraniumletter INTERNATIONAL

the international independent information and advice bulletin for uranium resource investments

Quarter 2, 2018

Uranium Market Outlook

Marino G. Pieterse, publisher and editor



► Uranium industry fails to react to curtailment of uranium mining operations

In my **Market Outlook** of December 2017, I already said that a narrowing gap between spot- and long-term U3O8 price would be needed to underpin an improving uranium market sentiment.

OVERVIEW of U3O8 PRICES

	Spot		Long-term		Spot	Long-term
2018						
April 9	**21.00**		**29.00**	**Year-end 2016**	**20.25**	**30.00**
March 26	**21.10**		**29.50**	Year-end 2015	34.25	44.00
February 26	**21.25**		**30.00**	**May 31, 2015 (year high)**	**39.50**	50.00
January 29	**22.00**		**30.00**	Year-end 2014	35.50	49.00
2017				**May 14, 2014 (year low)**	**28.25**	49.00
Year-end	23.75		30.67	Year-end 2013	34.50	50.00
December 4 (high)	**26.50**		31.00	Year-end 2012	43.50	56.50
November 27	22.00		31.00	Year-end 2011	61.75	64.00
October 31	20.15		30.00			
September 27	20.25		31.50	Pre-Fukushima accident		
June 26	20.10		32.50	March 11, 2011	67.75	73.00
May 29	19.25		32.50			
May 1	22.50		33.00			
March 27	24.50		33.99			
February 28	22.25		32.50			
February 6	26.00		32.50			
January 31	24.50		32.50			
2016						
Year-end	20.25		30.00			
November 28	**18.00**	*	33.00			
October 31	18.75		35.50			
September 26	23.75		38.00			
June 27	27.00		40.50			
March 28	29.15		43.50			

* *spot price 12-* year low

Since then, **Cameco**'s shut-down of its McArthur River mine, the world's largest and highest-grade uranium mining operation and stat-owned **Kazatomprom** of Kazakhstan, with a production of 24,575 tonnes U in 2016 (40% of total world production), the world largest uranium producer, having announced a production cut over a period of 3 years, and further curtailments with other producers not only failed to have a positive effect, but didn't stop the ongoing weakness of the spot price, which declined from US$ 23.75/lb at year-end 2017 to a current price of S$ 21.00.

Nevertheless, industry experts stick to their belief that for a recovery of the uranium prices is just a question of time, thereby pointing at the fundamentals remaining largely unchanged and projection that there are approximately 12 billion pounds utilities between 2018 and 2030, as stated by Denison Mines in a letter to its shareholders dated March 31, 2018.

With the spot price having recovered from US$ 20.25 at year-end 2016 to an interim high of US$ 26.50 on December 4, 2017, the spot price fell back to the current level of US$ 21.00, while the long-term price remained stable at a level around US$ 30.00 (currently US$ 29.00).

So, the big question is why at a depressed spot price there is no forward buying by utilities to narrow the US$ 8 gap with the long-term price.

In this respect, it should be recognised that as a result of the shift in economic world order most of future growth in uranium demand, in particular from China, Russia and India, will be provided by a surplus in supply from strategic blocks, rather than through the open market.

► Shift in economic world order will have crucial impact on the uranium market

Overview of strategic blocks

	Uranium production 2016 (tonnes)	in %	Uranium required 2017 (tonnes)	Surplus (+) Deficit (-)
USSR				
Kazakhstan	24,575	40	0	24,575
Russia	3,004	5	5,380	-2,376
Uzbekistan	2,404	4	0	2,404
Ukraine	1,005	2	1,944	-939
	30,988	51	7,324	23,664
USA	1,125	2	18,996	-17,871
Canada	14,039	23	1,592	12,447
	15,164	25	20,588	-5,424
China	1,616	3	8,289	-6,673
Australia	6,315	10	0	6,315
	7,931	13	8,289	-358
Japan *	0	0	662 x	-662
South Korea	0	0	4730	-4,730
	0	0	5,392	-5,392
Niger	3,477	6	0	3,477
Namibia	3,315	5	0	3,315
	6,792	11	0	6,792

x uranium required based on 5 operating nuclear reactors; 21 reactors are in process of restart

Considering that globalization is creating a new economical world order, it is interesting to see which countries are supplying uranium. This is of crucial importance for the course of uranium pricing and is disturbing the long awaited strong recovery to a pre-Fukushima price level of $ 65-70/lb to enable en economically viable production..

Anticipating a strong growth of nuclear reactors under construction and of planned reactors, led by China, Russia and India, whch three emerging countries accounting for 54% of reactors under construction and 53% planned, it is important to know which countries will meet the supply of required uranium.

From this perspective, I refer to my overview of geographical strategic blocks, that shows that Kazakhstan based at a production of 24,575 tonnes in 2016, is not only by far the world's biggest uranium supplier, but can easily fully feed growing market demand from Russia, without any impact on the uranium price.

In addition, as part of the **USSR block**, Kazakhstan and Russia are also in a strategic position to trade uranium with other strategic blocks that are facing a deficit in supply. The USA could be supplied by Canada, and China by Australia.

Top 10 countries of the world's uranium producers

	Production in tonnes U 2016	2016 in % world total	Production in tonnes U 2015	2014	2013	2010	2010 in % world total
Kazakhstan	24,575	40	23,800	23,127	22,451	17,803	33
Canada	14,039	23	13,325	9,134	9,331	9,783	18
Australia	6,315	10	5,672	5,001	6,350	5,900	11
Niger	3,477	6	4,116	4,057	4,518	4,198	8
Russia	3,004	5	3,055	2,990	3,135	3,562	7
Namibia	3,315	5	2,993	3,255	4,323	4,496	8
Uzbekistan (est)	2,404	4	2,385	2,400	2,400	2,400	4
China (est)	1,616	3	1,616	1,500	1,500	827	2
USA	1,125	2	1,256	1,919	1,792	1,660	3
Ukraine (est)	1,005	2	1,200	926	922	850	2
Top-10 total	**60,875**	**98**	**59,418**	**54,309**	**56,722**	**51,479**	**96**
Others	1,137	2	1,100	1,908	2,648	2,192	4
Total world production tU	**62,012**	**100**	**60,518**	**56,217**	**59,370**	**53,671**	**100**

source: WNA

► Worldwide nuclear capacity continues to grow in 2016; WNA targets nuclear energy to provide up to 25% of total electricity in 2050

Global nuclear generating capacity increased slightly in 2016 to 291.6 GWe net, up from 382.2 GWe at the end of 2015. Ten new nuclear power reactors with a combined generating capacity of 9,479 MWe came online in 2016. Five of these were in **China**, one in **South Korea**, one in **India**, one in **Pakistan**, one in **Russia** and one in the **United States**.

China started construction of the 1,080 MWe Tianwan 6 and the 1,150 MWe Fangchenggang 4 during 2016. In addition, China General Nuclear also started construction of a 60 MWe floating nuclear power plant project. Construction was also started last year at unit 3 of **Pakistan**'s Karachi nuclear plant, where work on unit 2 began in 2015.

Three power reactors with a combined capacity of 1,402 MWe were officially shut down in 2016. These were Ikata 1 in **Japan**, Fort Calhoun in the **US** ad unit 3 of **Russia**'s Novovoronezh plant.

At the end of 2016 there were 447 reactors operable around the world totaling 391.4 GWe net, and 60 under construction (64.5 GWe gross). This compares with 439 reactors in operation at the end of 2015, with a total 382.6 GWe.

The World Nuclear Association ("WNA") has developed its own vision for the future of electricity, referred to as Harmony. This is based on the International Energy Agency's 2-degree scenario which aims to avoid the most damaging consequences of climate change and required a significant increase in nuclear energy. The Harmony goal envisages a diverse mix of low-carbon generating technologies deployed in such a manner that the benefits of each are maximized while the negative impacts are minimized.

WNA's goal for nuclear is to provide 25% of total electricity generating in 2050 is based on the nuclear industry capable of adding 50 GWe of capacity in 2015-2020, 125 GWe in 2020-2025 and 825 GWe in 2025-2050.

United Nations change report calls for World action on carbon emissions and leaves nuclear power as the only mature source

The report required the global share of low-carbon options for electricity supply – nuclear power, renewable, bio-energy and carbon capture and storage (CCS) from fossil fuels collectively to increase from its current levels of 30% to reach 80% by 2050, hence effective quadrupling them.

However, CCS is unproven and its economic practicality is simply a hope, bio-energy to replace fossil fuels raises questions of scale, wind and solar renewable are well-proven along with their intrinsic limitations leaving nuclear power as the only mature viable clean and cost-effective alternative for fossil fuels (oil, gas, coal) providing power and demand regardless of weather or time of day.

Paris Climate Agreement confirms essential contribution of nuclear energy as the only large-scale source to limit global warming

On 4 November 2016, the Paris Climate Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) entered into force, dealing with greenhouse gas emissions mitigation, adaptation and financing starting in the year 2020.
The aim of the convention is holding the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change.

The contribution that each individual country should make in order to achieve the worldwide goal are determined by all countries individually and called "nationally determined contributions (NDCS).

The contribution should be reported every 5 years and are to be registered by the UNFCCC Secretariat. Countries can corporate and pool their nationally determined contributions.

With 195 countries having adopted the first-ever universal climate agreement on 12 December 2015 and entered into force on 4 November 2016, which sets out a global action plan to put the world on track to avoid dangerous climate changes by limiting global warming to 1.5C, executing the plan is jeopardized by a variety of national directives in many countries to cut CO2 emission through the transmission of electricity generating from fossil fuels to renewable energy and also recognizing the essential contribution of nuclear energy as the only large-scale alternative to replace fossil fuels.

In other words, it will not be possible to change the current mix of energy sources of major industrial countries, applying both to the United States and Europe, in particular Germany, and emerging countries, led by China, India and Russia, with most of these countries heavily dependent on coal energy as the dirtiest energy provider.

In this respect, it is noteworthy that the Kyoto Protocol in 2009, which targets a 20% cut in CO2 emission by 2020, did not result in any improvement to date and the situation actually worsened due to the rise of worldwide industrial output, with the United States and China the biggest climate contaminators.

On the side line of the Paris Agreement it is good to learn that nuclear energy remains an essential component in the action plan, thereby recognizing that in the Western world the share of nuclear energy is approximately 30% of total world consumption and approximately 11% worldwide. With China and India representing only 2.6% and 3.5% respectively of national electricity consumption, these two countries have ambitious plans to multiply the share of nuclear energy in total consumption. In addition, a growing number of emerging countries have planned construction of nuclear plants to diversify their pallet of energy providers.

In this respect, it is noteworthy that the disaster of Tsjernobil in 1996 was due to human failure and the Fukushima disaster in March 2011 to be accounted for by a “tsunami” that followed the heavy earthquake as a combined one-time disaster, and since then not having recognized that today’s new generation of nuclear reactors meets the highest possible safety requirements.

WORLD NUCLEAR POWER REACTORS & URANIUM REQUIREMENTS of the world's major nuclear energy generating countries *(as at April 1, 2018)*

Country	Reactors operable	Nuclear electricity generation 2016 (TWh)	% total electricity generation	Under construction	Planned *	Uranium required in tonnes 2017
USA	99	805.3	19.7	2	14	18,996
France	58	384.0	72.3	1	-	9,502
China	38	210.5	3.6	20	39	8,289
Russia	37	179.7	17.1	5	26	5,380
South Korea	24	154.2	30.3	4	1	4,730
India	22	35.0	3.4	6	19	843
Canada	19	97.4	15.6	-	2	1,592
Ukraine	15	81.0	52.3	-	2	1,944
United Kngdom	15	65.1	20.4	-	11	1,772
Germany	7	80.1	13.1	-	-	1,480
Japan x	5	17.5	2.2	-	-	662
Total	**339**			**38**	**114**	**55,190**
Total world	**449**		**c10.6**	**57**	**157**	**65,014**
Top 11 in % world total	**75**			**68**	**73**	**85**

* *Future reactors envisaged in specific plans and proposals and expected to be operating by 2030*

x In ***Japan***, *currently 42 reactors are operable and potentially able to restart, of which 7 reactors operable, including 2 reactors to start in April..*
A further 19 reactors are in the process of restart approval.
With the country's 55 main reactors having provided some 30% of electricity before the Fukushima nuclear accident on March 11, 2011, this was expected to increase to at least 40% by 2017. The prospect now is for 20-22% of Japan power generation in 2030.
The remainder of the country's power generation will be met by coal (26%), LNG (27%) and oil (3%)

Operable	=	Connected to the grid
Under construction	=	First concrete for reactor poured or major refurbishment
Planned	=	Approvals, funding or commitment in place, mosty expected in operation within 8 - 10 years (to be operated by the late 2020s)
Proposed	=	Specific program or site proposal timing or start of operations very uncertain

TWh = terawatt hour (billion kilowatt hours);
kWh = kilowatt hour;
MWe = megawatt (electrical as distinct from thermal)

New plants coming on line are largely balanced by old plants being retired. Over 1996 – 2016, 80 reactors were retired s 96 started operation. The reference scenario in the 2017 edition of the Nuclear Fuel Report has 140r reactors closing by 2035 and 224 new ones coming on line (figures include 22 Japanese reactors on line by 2035).

Source: WNA

USA accounts for more than 30% of worldwide nuclear power generation of electricity

The **USA** is the world's largest producer of nuclear power, accounting for 33% of worldwide nuclear generation of electricity. The country's 100 nuclear reactors produced 798 billion kWh in 2015, accounting for 19.5% of its total electricity generated. At the end of 2016 there are now 99 nuclear power reactors operable generating 99,535 GWe net and 4 under construction.

Following a 30-year period in which few new reactors were built, it is expected that 6 new units may come on line by 2020, 4 of these resulting from 16 licence applications made since mid-2007 to build 24 new reactors.
However, lower gas prices since 2009 have put the economic viability of some existing reactors and proposed projects in doubt.

Government policy changed since the late 1990s have helped pave the way for significant growth in nuclear capacity. Government and industry are working closely on expedited approval for construction and new plant design. The industry invests about $ 7.5 billion per year in maintenance and upgrades of the plants.

By February 2016, the Nuclear Regulatory Commission (NRC) reviewed the operating licences of 83 reactors (79 still operating), over 80% of the US total and about 30 were actually I their 40-60 year age bracket.
The NRC is considering licence renewal applications for 11 further units, with ore applications expected.

The NRC is now preparing to consider extending operating licences beyond 60 to 80 years, with the Subsequent Licence Renewal (SLR) programme.

Despite a near halt in new construction of more than 30 years after the Three Mile Island, Pennsylvania accident in 1979, US reliance on nuclear power has grown. In 1980, nuclear power produced 251 billion kWh accounting for 13% of the country's electricity generation. In 2008, that output had risen to 890 billion kWh and nearly 20% of total generated electricity.

Most of the increase came from the 47 reactors all approved for construction before 1977, that came online in the late 1970s and 1980s, more than doubling the US nuclear generation capacity. The US nuclear industry has also received remarkable growth in power plant utilisation through improvement refuelling, maintenance and safety systems of existing plants.

In 2015, the US electricity generating was 4,094 kWh (billion kWh) net, 1,582 TWh (39%) of it from coal-fired plant, 1,138 TWh (29%) from gas, 797 TWh (19.5%) nuclear, 259 TWh (6%) from hydro and 279 TWh (7%) from other renewables. In 2015, 727.5 TWh (19.3%) was generated from nuclear energy.

Coal is projected to retain the largest share of the electricity generation mix to 2035, though by 2020 about 29 GWe of coal-fired capacity is expected to be retired due to environmental constraints and low efficiency coupled with a continued drop in the fuel price of gas related to coal.

Given that nuclear plants generate nearly 20% of the US's electricity overall and 63% of its carbon-free electricity, even a modest increase in electricity demand would require 13.2 GWe of new nuclear capacity by 2025 in addition to the 5 nuclear pans currently under construction in order to maintain this share.

If today's nuclear plants retire after 60 years of operation 22 GWe of new nuclear capacity would be needed by 2030, and 55 GWe by 2035 to maintain a 20% nuclear share.

During 2016, owners and operators of US nuclear power reactors purchased 50.6 million pounds of uranium.

About 11% of the uranium delivered to US reactors in 2016 was produced in the United States and 89% came from other countries. Nearly half of these purchases originated from 2 countries, Canada (25%) and Kazakhstan (24%), providing 17 million pounds and 11 million pounds of uranium respectively, followed by Australia (20%) and Russia (14%).

► Fossil fuels remain to have most influence on Trump's energy policy

On December 18, 2017, President Trump unveiled his National Security Strategy (NSS), which unveiled organizing principals to guide U.S. foreign policy and has been welcomed by foreign policy experts as a large balanced strategy that could service the Trump administration well if enacted.

Although the energy part of the report is provocatively titled "Embracing Energy Dominance", a closer reach reveals a reasonable vision of energy policy grounded in a self-consistent case for why economic strength and energy security underpin national security.

The NSS energy strategy aims to support allies and partners, encouraging North American energy cooperation, and tempers the definition of energy dominance suggested elsewhere, asserting that such dominance arises from America's central position in the global energy system as a leading self-sufficiency producer, leading consumer and innovator.

For example, the strategy calls for reducing regulatory barriers to energy production by putting more than 10 million acres of land in Alaska on the auction block for oil and gas companies.
Alaska is not the only place were Trump's plan to drill has met with tough market realties. The Administration has taken steps to open millions of acres to oil drilling across the county and off the coast of the U.S. from using the tax reform bill as a vehicle to open drilling in the Arctic National Wildlife Refuge to considering most of the waters of the U.S. coasts for oil exploration. But analysts and key industry players say it remains uncertain how much of it will actually be developed to produce oil and gas.

With oil prices having remained too low until recently to poor billions into exploring vast new areas offshore, in the Arctic and Alaska, would be a risky investment for drilling, the recent rise of Brent-oil price to a 3-year high of $ 70 is more than helpful to bring the U.S., the world's largest oil producer, in a position to stress the country's "Energy dominance" to the rest of the world.

No matter the market conditions, Trump's presidency has largely been a win for America's oil and gas industry. Regulations have been cut back, oil companies could soon have unprecedented access to land long out of their reach and perhaps most significantly, at least in the short term, oil companies by and large received a massive tax cut. Trump's Environmental Protection Agency initially entertained a plan from oil reforms to upend regulations requiring them to blend ethanol into their gasoline – then rejected it after a backlash from the ethanol industry.

Trump and others in his administration have criticized renewable energy as expensive and dependent on government support.
But the White House has not sought the repeal tax breaks expected to provide $ 12.3 billion to the renewable energy firms by 2020, which other Republicans continue to support.

Fossil-fuel firms clearly have more influence on policy under Trump and easier access to decision makers. Their policy victories include rollbacks of regulation limiting emissions of carbon, methanol and other pollutants; the opening of Alaska's Arctic National Wildlife Refuge to drilling; and the lifting of a coal-mining moratorium on federal lands.

Over the last decade France has exported up to 70 TWh net each year and Electricité de France (EDF) expects net exports to continue at 55-70 TWh/yr, principally to Italy, the UK, Switzerland, Belgium, Spain and Germany.

►Call for US government to revitalize its nuclear industry

The **US government** should hold a "structured conversation with the country's nuclear industry" on ways to restore and develop the sector, according to an assay from Mark Hibbs, senior fellow of the Carnegie Endowment for International Peace's nuclear programs.

Thereby, he is not only referring to America's nuclear power plant construction industry staggering or even in decline, but also to pressure from loss of know-how and high costs. US nuclear power plant vendors are now challenged by Chinese and Russian exporters, whose governments' view nuclear energy in strategic, not commercial terms.

Through strategic penetration, with both China and Russia having signed memorandums of understanding and other bilateral agreements with potential customer countries, these agreements will provide these two countries Access to strategic decision making in these countries concerning technology, energy and foreign policy for decades to come.

During the last 20 years, while China and Russia built dozens of reactors at home, leading Western vendors virtually stopped constructing new units.

Hibbs warns the USA could "lose its leadership in international nuclear governance" in the face of a future shift towards newcomers and away from established nuclear technology-owning countries and recommends that the Trump administration should discuss with the US nuclear industry what steps the government should take "to enhance US nuclear exports and encourage a level international playing field for ongoing nuclear equipment, material and technology, especially to risk-bearing destinations.

► Energy Fuels and Ur-Energy jointly file a petition with the U.S. Commerce Department to investigate effects of uranium imports on U.S. national energy

Just before publication of my January 2018 **Market Outlook,** thereby in particular referring to the attention I paid to the impact of geopolitical strategic blocks on nuclear energy generation and the price-making of the uranium market, **Energy Fuels** and **Ur-Energy**, the two main U.S. uranium producers, together supplying more than half of all U.S. Uranium in 2017, announced that on January 16 they jointly submitted a Petition to the U.S. Commerce Department ("DOC") for Relief under Section 232 of the Trade Expansion Act of 1962 (as amended) from imports of uranium products that threaten National Security, and the President to use his authority to adjust imports to ensure a long-term viability of the U.S. uranium mining industry.

In 2017, U.S. uranium production fell to near historic lows due in large part to uranium and nuclear fuel imported from state-subsidized foreign entities; 2018 domestic production is likely to be even lower.

In my view, it would speak for itself when **Energy Fuels** and **Ur-Energy**, both headquartered in Denver, Colorado, would lend weight to their action by amalgamating their operations.

►US Congress approves US$ 1.2 billion budget for nuclear energy

On March 23, 2018, it was announced that both houses of the US Congress have approved the Consolidation Appropriations Act 2018, which appropriates some US$ 1.3 trillion of US treasury funds for fiscal 2019, which begins on October 1, 2018, including US$ 1.2 billion for nuclear energy, which is significantly more than the US$ 703 million in the president's fiscal 2018 budget request for the Department of Energy (DOE).

The bill will see the suspension of sales by the DOE of surplus uranium to pay for decommissioning wot at the former Portsmouth uranium enrichment plant in Piketon, Ohio. DOE had been transferring 2,100 tU per year of excess uranium not needed for national security in exchange for services at Portsmouth and, also for the down blending of high-enriched uranium, in a process known as "bartering".

With 27% of electricity produced from nuclear energy, Europe remains important component of the EU's energy mix in the 2050 horizon

On April 6, 2016, the nuclear trade body for the EU, **FORATOM**, has stated the target after submitting a draft communication "Nuclear Illustrative Programme" ("PINC") for the European Commission, which expects 14 EU Member States to be operating nuclear power plants (NPPs) in 2050.

In its further commentary on PINC 2016, published on November 20, 2016, **FORATOM** considers that the draft Communication offers a "Snapshot of nuclear energy in Europe and what is now needed is a vision and strong leadership in order to promote nuclear as a part of solution to climate change, in view of the agreement the COP21 conference in Paris and the EC's important role in security it, as well as to meet the other two pillars of the European Union which are security of supply decarburization of the electricity sector and competitive power prices.

The draft Communication PINC underlines many positive aspects of the current situation of nuclear power, such as the fact that nuclear energy is part of the energy mix of half of the EU Member States, which includes the UK.

In those countries that choose to use it, nuclear has a role to play in ensuring the security of electricity supply. With 27% of electricity produced from nuclear energy and 27% from renewable sources, the EU n 2016 generated more than half of their electricity without producing greenhouse gasses.
It also notes that in 2016 based on 120 nuclear power reactors in 14 Member States, including 15 reactors in the UK, with a total capacity of 120 GWe and an average age close to 30 years.

Maintaining a nuclear generation capacity between 95 and 105 GWe in the EU, including the UK, until 2050 and beyond will require, as stated in the draft Communication, further investments over the next 35 years. Between EUR 350 and 450 billion will have to be invested in new plants replace most of the existing nuclear power capacity. Since new nuclear power plants are designed to operate for at least 60 years, these new plants would generate electricity until the end of the century.

European Union: estimated 126 nuclear reactors in 2017 operating in 14 countries, including UK before Brexit

	Number of reactors	in % of total electricity generating
France	58	72.3
UK	15	20.4
Sweden	8	40.0
Germany	7	13.1
Spain	7	21.4
Belgium	7	51.7
Czech Republic	6	29.4
Finland	4	33.7
Hungary	4	51.3
Slowakia	4	54.1
Romania	2	17.3
Bulgaria	2	35.0
Slovania	1	35.2
Netherlands	1	3.4
Total	126	

source: WNA

No nuclear reactors operating in 14 EU countries

Italy
Portygal
Poland
Ireland
Croatia
Austria
Denmark
Luxembourg
Greece
Estinia
Latvua
Lithuania
Malta
Cyprus

Expecting 14 EU member states to follow the PINC program, which is in accordance with the current number of 14 countries operating nuclear reactors, but considering the Brexit, **Germany** phasing out its reactors, and **France** lowering its number of plants, the table below shows that the EU would be almost fully dependent on increasing nuclear energy capacity in Eastern European countries that besides growing political turmoil in some of these countries are economically not in a position to carry out a successful transmission from fossil fuels to nuclear energy and renewables.

Expected strong future growth of nuclear demand is not anymore determined by the **US** and **EU**, but by **China**, **Russia** and **India**. Nuclear electricity generating in 2016 in the US was almost five times higher than in China and more than doubled combined nuclear electricity generating from the three emerging countries combined. It was 4% higher than in the EU, dominated by **France**, representing a share of approximately 50% of total EU nuclear energy generating.

While the **United States** is anticipated to consolidate a 19%-20% share of nuclear in total electricity generating, in Western Europe nuclear energy generating will come under pressure which will be politically offset by the construction of nuclear reactors in Eastern European countries.

In 2017, the **US** and **European Union** required 17,847 tonnes uranium and 17,266 tonnes uranium, respectively, compared with a combined uranium requirement of 16,615 tonnes uranium for **China**, **India** and **Russia**.

With a currently combined number of 97 reactors operable, 31 reactors under construction and 84 reactors planned, the latter 3 countries require annual uranium demand to grow by 14,000 tonnes in the next 5 years.

► Nuclear phase out in Germany in conflict with EU energy strategy

With Germany having made a decision to fully phase out nuclear to address the Energiewende to new energy, not avoiding to remain heavily dependent on coal and the import of nuclear energy from France, the conclusion can only be that bureaucratic Europe will not be capable to meet the CO2 emission free targets set by the Paris Climate Agreement.

In the **European Union** and the United Kingdom, there are 126 nuclear reactors operating of which 58 reactors in France, representing 48% of the total EU operating reactors are the more illustrative example that politically left mining approach against nuclear energy as the only large-scale source of emission free electricity generating, is dated by not recognizing the technical and innovative evolution in the nuclear industry.

This is underlined by the introduction of a second and third generation of nuclear reactors, which have satisfied ultimate safety and environmental requirements, and is not only being fully recognized by the United States and major emerging countries, led by China, but also in Japan. Despite the Fukushima disaster in March 2011, Japan has planned to restart 28 of its nuclear reactors, which offer a mature viable clean and cost-effective alternative for fossil fuels, and have a positive impact on securing economic growth.
In this respect, it has to be noted that the EU follows a controversial energy policy by allowing its member countries to follow independent strategies, as demonstrated by conflicting energy policies of France and Germany, and the UK in favor of nuclear energy, against Italy abandoning nuclear energy.

The established nuclear trade body of the EU, **Foratom**, that works on a revised version of Illustrative Program for Nuclear Energy, known as **PINC**, recommends to the EU to facilitate nuclear development projects by providing a stable regulatory and investment frame work given the importance of nuclear power for achieving its climate action goals as set by the **Paris Climate Agreement**.

The European Commission concludes that "as a low carbon technology and a significant contributor to security of supply and diversification, nuclear energy is expected to remain an important component of the EU's energy mix in the 2050 horizon".

European energy targets are out of reach

With Western Europe for approximately 30% dependent on the import of Russian gas, the energy targets of the EU with the primary focus on renewable, in conjunction with Germany having phased out nuclear energy, are not realistic and as such not achievable.

This view is emphasized by the European Council having set a target of meeting 20% of EU energy needs from renewals by 2020, individual countries *have* been left the decision on their own policies in such a way as to allow nuclear power as part of their energy mix to be taken into consideration in allocating individual country targets for renewables.
In this respect, it is striking to see that major European countries have totally different views on the energy mix to follow.

While **France** with a share of 76% represents by far the highest share of nuclear energy, which it intends to bring back to 50% to the full benefit of renewable energy, **Germany** has decided to fully phase out nuclear power. After already having shut of its originally 17 old plants, nuclear's share in total electricity generation is currently around 14% of total electricity.

More than half of Germany's electricity is generated from coal which is subsident by some € 2.5 billion (US$ 3.3 billion) each year (no subsidies), while the combined subsidies from wind and solar plants total some € 5 billion per year.

The decision to shut all its nuclear plants will cause dramatic economic and environmental consequences. Despite the massive investment in renewable energy, this will create an extra 300 million tons of CO2, by 2020 due to increased use of fossil fuels. That will virtually cancel out the 335 million tons of CO2 savings required under the terms of the European Commission's 2011 Energy Efficiency Directive.

China to dominate future global nuclear power market, including expansion abroad

As of Aril 2018, **China** has 38 nuclear reactors with a capacity of 34.6 GWe operating, compared to worldwide number of 449 reactors with a capacity of 394.1 GWe. The country has 20 reactors under construction. In addition, 39 reactors are planned, including some of the world's most advanced, to give an almost doubling of nuclear capacity to 58 GWe by 2020-21, then up to 120 to 150 GWe by 2030.

China's policy is to have a closed nuclear fuel cycle and to become largely self-sufficient in reactor design and construction, as well as other aspects of the fuel cycle, but is making full use of western technology dawn from France, Canada and Russia, while adapting and improving it.

The State Council's Energy Development Strategy Plan 2014-2020 said that China's efforts should be focused on promoting the use of large pressured water reactors (including the AP 1000 and CMP 1400 designs), high temperature gas-cooled reactors (HTSs) and fast reactors. It also said that research should be conducted to "improve the nuclear fuel cycle system, including reprocessing of used fuel".

In **China**'s 13th Five Year Plan from 2016, 6 to 8 nuclear reactors are to be approved each year. Non-fossil primary energy provision should reach 15% by 2020 and 20% by 2030 (from 9.8% in 2013). At that time China intends its peak of CO2 emissions to occur.

► Including environmental protection, vigorous development of nuclear power is required

Coal's share of primary energy in China was down to 64.4% in 2015 from 72.5% in 2007. The action plan aim was 62% in 2020. After 21.5 GWe of coal capacity was added in the first half of 2016, in September the NEA issued a notice halting all construction and approval for coal plants in 28 provinces until their overcapacity is reduced. From this perspective, to phase out nuclear energy in Germany was a stupid decision, which will have a negative impact on the country's economy, reflected by twice as high end consumer prices than in France.

► China National Nuclear Corporation holds 25% in Paladin Energy's Langer Heinrich uranium mine in Namibia

China National Nuclear Corporation's (**CNNC**") subsidiary CNNC Overseas Uranium Holding bought a 25% joint venture equity stake in Langer Heinrich or $ 190 million in January 2014, with the option to acquire Paladin Energy's 75% share of the Namibian mine. The option was not exercised however within 30 days from July 20, 2017, which date was set by the administrators of Paladin and having been followed by an agreement on a new financing facility.

Independent experts determined the fair market enterprise value of the Langer Heinrich mine's holding company to be $ 583 million, and a fair market price for Paladin's share of the Company's capital of $ 170 million,
Taking into account a discount of 50% to which CNNC would be entitles under a shareholder's agreement, this would mean Paladin would receive $ 416 million.

The restructure included the issue of new notes to the value of US$ 115 million, with a five-year tenor at an interest rate of 10% per annum.

Langer Heinrich produced 4,149 million pounds U3O8 in 2017, down 13% from the previous year's total of 4,763 million pounds U3O8. This reduced production was directly attributable to the implementation of the mining curtailment strategy which saw throughput grade reducing to 610 ppm for the year, down 13% from 2016.
C1 cash costs of production was reaching an all-time low of US$ 19.91/lb. Underlying all-in cash expenditure decreased 3% from US$ 38.75/lb to US$ 2995/lb.

Total reserve ore estimate (250 ppm U3O8 cut-off) is 89.01 Mt grading 0.046% U3O8 containing 91.0 million pounds U3O8.

► CNNC International holds largest equity position in SOMINA joint venture in Niger

In Niger, the world's 4th-ranking producer of uranium, providing about 7% of world mining output from Africa's highest-grade uranium area, two significant uranium mines were discovered; the first in 1957 by the French Bureau de Recherches Géologiques et Minières ("BRGM") followed by Akoute (COMINAK) set up in 1974.

The Société de Mines d'Azelik ("SOMINA") was established in 2017 to mine Azelik/Teguidda, 160 km southwest of Arlit and 150 km northwest of Agadez in the Agadez region.

China's CNNC International is SOMINA's largest shareholder with 37.2%. The Niger government holds 33%, ZXJOY Invest (Chinese) 24.8% and Korea Resources (KORES) 5%.
In February 2015, CNNC announced that the mine would be closed ad put on care and maintenance due to "tight cash flow". It had earlier hoped to raise production to 2,500 t/yr by 2015 and double that by 2020.

In 2015, **Russia** generated 1,068 TWh electricity with 530 TWh coming from gas, 195 TWh coming from nuclear power, 170 TWh from hydro and 159 TWh from coal. Net exports were 2 TWh and final consumption was 726 TWh (after transmission losses of 107 TWh and own use/energy sector use of 223 TWh). Rosenergoatom, Russia's sole nuclear utility, reported 2016 production as 196 TWh, with a target of 200 TWh in 2017.

Gazprom cut back on the very high level of natural gas supplies for electricity generation because it can make about five times as much money by exporting gas to the west (over 30% of EU gas comes from Russia). In 2012 Gazprom exports were expected to reach $ 84.5 billion, $ 61 billion of this to Europe. Gazprom gas exports to western Europe increased by 20% over 2010 to 2016 and in 2015 were 158.6 billion cubic metres.

A revised scheme of the government's Energy Strategy 2030 projected 1,288 TWh demand in 2020 and 1,553 TWh in 2030, requiring 78 GWe of new plant by 2020 and total 176 GWe new built by 2030, including 43.4 GWe nuclear. The scheme envisaged decommission 67.7 GWe if capacity by 2030, including 16.5 GWe of nuclear plant (about 70% of present capacity). New investment by 2030 of Rouble 9,800 billion (US$ 168.5 billion) in power plants and Rouble 10,200 billion (US$ 160.9 billion) in transmission would be required.

In May 2015, the Ministry of Economic Development announced a "very significant" delay due to a "current energy surplus". Rosatom said it expected to commission 15 further reactors of 18.6 GWe by 2030, reaching 44 GWe then (so presumably no retirements).

Aiming to supply 25% of electricity from nuclear power by 2050, India plans to tenfold uranium output growth

On March 7, 2018, Minister of State Jilendra Singh told the country's parliament that **India** is planning a tenfold increase in uranium production by 2030. State company Uranium Corporation of India ("UCIL") has outlined expansion plans to meet the Department of Atomic Energy's ("DAE") vision of achieving self-sufficiency in uranium production.

The plan includes maintenance of sustained supply from existing facilities, capacity expansion of some existing units and construction of new production centres (mines and plants) in different parts of the country, Sigh said.
The expansion is planned in three phases with the first "expected to increase production to 3.5 tons existing levels by the 12th year". Completion of projects in the second phase is expected to achieve a sevenfold expansion over current production with the third phase of projects leading to a tenfold increase over current levels by 2031-2032.

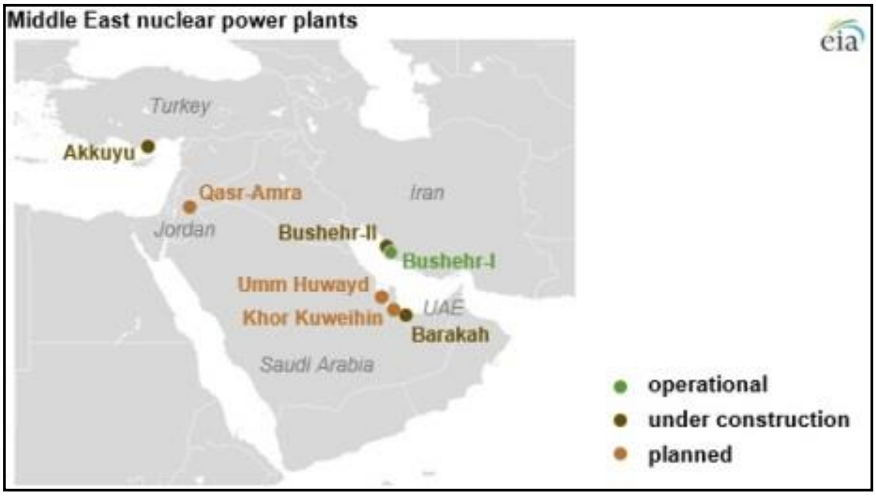
According to the 2016 edition of the OECD Nuclear Energy Agency and International Atomic Energy Agency joint report on uranium resources, production and demand (the "Red Book"), India's known conventional uranium resources and - reasonably assumed resources and inferred – were estimated to be 181,606 tU as of January 2015.
Uranium mills currently operate at Jadugudah and Turamdik, both in Jjarkland, and Tummalapalle in Andhra Pradesh. India produced 385 tU in 2015.

India operates 22 nuclear reactors, eight of which are fuelled by indigenous uranium. Fourteen reactors are under international safeguards and use imported uranium. Six units – four indigenously designed pressurised heavy water reactors, a fast breeder reactor and a Russian-designed pressurised heavy water reactor – are currently under construction.

Construction is planned to begin on 19 further units within the next few years, including the indigenously designed PHWRs, which are scheduled to start up by 2031. Agreements envisage the import of uranium up to 2020, Singh said.

► Middle East nuclear power to quadruple in ten years

The US Energy Information Administration (EIA) said on March 5, 2018 that nuclear electricity generation capacity in the idle East is expected to increase from 3.6 gigawatts in 2018 to 14.1 GWe by 2028 thanks to new construction star-ups and recent agreements between Middle Eastern countries and nuclear vendors.
The **United Arab Emirates (UAE)** will lead near-term growth by installing 5.4 GWe of nuclear capacity by 2020, it said.



The projections follow the EIA's International Energy Outlook, published last September, which represents an assessment of international energy markets through to 2050. "The growth in nuclear capacity in the Middle East is largely attributable to countries in the region seeking to enhance energy security by reducing reliance on fossil fuel resources", the EIA said, noting that fossil fuels accounted for 97% of electricity production in the region last year, with natural gas accounting for about 66% electricity generation and oil for 31%. The remaining 3% comes from nuclear, hydropower and other renewables.

Middle Est countries are also adapting nuclear generation to meet increasing electricity demand resulting from population and economic growth, the EIA noted. Regional electricity production was more than 1 terawatt hour last year, and EIA expects electricity demand to increase3 30% by 2028.
This growth is higher than the global average of 18% over the same period, and higher than the 24% expected growth in non-OECD countries.

► Other countries to be in favour of nuclear energy

EIA listed the five key developments in the region.

● **Iran** is building a two-unit nuclear plant, Bushehr-II, which is designed to add 1.8 GWe of nuclear capacity when completed in about 2026. Bushehr-I facility, which came online in 2011, was the first nuclear power plant in the Middle East. It has one 1000 MWe reactor unit producing about 5.9 GWh of electricity per year.

● The **UAE** is constructing the four-unit Barakah nuclear power plant, which is expected to be completed by the end of 2020. The 1300 MWe Barakah unit 1, which was started in 2012 and completed last year, is expected to begin electricity production by the middle of this year.

● **Turkey** began construction of the Akkuyu nuclear power plant late last year. This is a four-unit facility designed to add 4800 MWe of nuclear capacity to Turkey's generation mix. The first reactor unit is scheduled to be completed by 2025.

● **Saudi Arabia** is planning to build its first nuclear power plant and is expected to award a construction contract for a 2800 MWe facility by the end of this year. It has solicited from five vendors from China, France, Russia, South Korea and the USA to carry out the engineering, procurement, and construction work on two nuclear reactors. Construction is expected to begin in about 2021 at one of the two proposed sites - either Umm Huwayd or Khor Duweihin.

● **Jordan** plans to install a two-unit 2000 MWe nuclear plant and has been conducting nuclear feasibility studies with Russia's Rosatom since 2016. In early 2017, Jordan solicited bids for supplying turbines and electrical systems, and construction is expected to start next year and to be completed by 2024.

Kazatomprom JSC NAC has been the world leader in the extraction of uranium since 2009, ensuring around 20% of the global market demand today, after having announced to cut production by 10% due to ongoing challenging market conditions. To save its position, the Company will replenish its resource base of uranium, optimize all types of costs, and implement the advanced technologies directed to increase the efficiency of extraction of uranium and decrease the cost value of finished goods on a regular basis.

In 2015, the strategy of development of **Kazatomprom** for 2015-2025 was updated. In 2016, the first year of transformation, the Company increased its net income to 108 billion KZT (US$ 326 million), which is more than two-and-a-half times higher as compared to 2015.

Kazatomprom, together with CGNPC of China, has started to implement a breakthrough high-technology project in the nuclear industry, i.e. construction of a fuel assembly producing plant.
The new plant will annually produce 200 tons of nuclear fuel for Chinese NPP's and will have a guaranteed sale market for the next 20 years.

In 2016 important agreement were signed with foreign parties:

- The Company signed with Cameco on restructuration of **LLC JV "Inkai**" and increase of the share of Kazatom prom in the Joint Venture from 40% to 60% in 2018.
- The agreement with **CNPC** of **China** on the purchase of Kazakhstani fuel pallets to Chinese nuclear power plants until 2024.
- An agreement with **NAEC "Energoatom"** of Ukraine on the supply of enriched uranium production to the Ukrainian NPPs.

Kazatomprom outsourced 20 non-core businesses with the aim of increasing the value of the Company.

In 2016, **Kazatomprom** produced 13,187 tons of uranium, representing a 24.2% share in the global market, 17.47 tons of beryllium and 121.8 tons of tantalum and 46.8 tons of niobium.
Production volume of electrical power decreased 2.4% from 5,154 million kWh in 2015 to 5,032 kWh in 2016.

Income from products sale and vendor service increased 5.3% from 397 million KZT (US$ 1.19 million) in 2015 to 418.9 billion KZT (US$ 1.26 billion) in 2016).
EBITDA increased 19.2% from 126.92 billion KZT to 151.27 billion KZT.
Cost of sales increased 4.8% from 294.4 billion to 308.5 billion KZT ($ 932 million).
Operating income amounted to 73.2 billion KZT ($ 220 million) compared to 73.6 billion KZT ($ 222 million) in 2015.
Profit for the year tripled from 36.5 billion KZT ($ 110 million) to 111.6 billion KZT ($ 337 million).

Cash and cash equivalent at the end of the year amounted to 75.1 billion KZT ($ 227 million).

The extraction of rare and rare-earth metals and the production of products are also a priority activity of **Kazatomprom**. In 2016, the Company continued to implement its development strategy in this area, as well as an active cooperation with foreign partners.

The SARECO Joint Project (**Kazatomprom** 51% and **Sumitomo** of Japan 49%) in 2016 continued work on the preparation for the operation of the plant to create high-tech production of rare earth products.
The SARECO plant in Stepnogorsk is a unique complex of thermal and hydrometallurgical processing of various types of raw materials.

The plant is designed to produce 1.5 thousand tonnes of TEEO per year within an increase in production capacity to 3 thousand tonnes of TREO in 2016 and up to 5-6 thousand tonnes of TREO per year by 2018-2019.
A consistent part of the produced products will be heavy rare-earths metals.

Kazatomprom's assets increased 3% from 793.3 billion KZT in 2015 to 820.0 billion KZT in 2016 (US$ 2.48 billion), of which 360.1 billion KZT ($ 1.08 billion) current assets.
Shareholders' equity increased 21% from 469.4 billion KZT in 2015 to 567.83 billion KZT (US$ 1.72 billion) in 2016.

The growth in Economic Added Value (EAV) amounted to 4 billion KZT from minus 10.3 billion KZT in 2015 to minus 6.4 billion KZT ($ 193 million) in 2016.
The growth was achieved due to the transformation program, the total effect of which in 2016 amounted to 16.2 billion KZT ($ 490 million) due to lower costs and introduction of category purchases.

Uranium One is the world's 4th largest uranium producer, with a globally diversified portfolio of assets located in **Kazakhstan**, the **United States** and **Tanzania**. In 2016, the Company produced 4,717 MT. ROSATOM State Atomic Energy, through its affiliates, is the major shareholder of Uranium One.

Attributable production for 2016 was 12.7 million pounds U3O8, compared to total attributable production of 12.5 million pounds during 2015.

Headline revenue was $ 314.6 million in 2016 compared to $ 324.7 million in 2015. Attributable revenue was $ 405.7 million for 2016 based on sales of 13.5 million pounds U3O8 of produced material at an average realized sales price of US$ 27 per pound U3O8 sold.
The total average cash cost per pound U3O8 sold of produced material decreased to US$ 9 per pound U3O8 during 2016, compared to $11 per pound during 2015.

Gross profit was S$ 41.9 million during 2016 compared to gross profit of $ 4.4 million in 2015.
Gross profit, including the Company's share of gross profit from equity accounted investees, totalled $ 132.5 million in 2016, a 35% decrease compared to $ 264.5 million in 2015, mainly due to a decrease of 22% in the averaged realized sale price, partly offset by an increase of 10% in sales volume.

Net earnings for 2016 were $ 252.6 million, compared to net earnings of $ 70.7 million for 2015. The adjusted net earnings for 2016 were $ 54.7 million after extension of a net gain received through business combination of $ 198.3 million, compared to an adjusted net earnings of $ 42.6 million for 2015.

In the first 9 months of 2017, **Uranium One** reported headline revenues of $ 196.1 million, compared to $ 238.6 million for the same period of 2016. Attributable revenues, including the revenues equity accounted inventories were $ 27.5 million, compared to $ 291.5 million for the same period of 2016.

Uraniumletter International ● a publication by **M**etal **C**ommodities **I**nvestment **P**latform, the Netherlands ● Marino G. Pieterse, Publisher and Editor ● Information and investment comments are independently and thoroughly researched and believed correct. No guaranty of absolute accuracy can be given however. ● Investment decisions are fully made for own risk ● tel.: +31-251-828247 ● Chamber of Commerce 58330445 ● www.metalcommodities-ip.com ● e-mail: marino.pieterse@metalcommodities-ip.com