

Uraniumletter INTERNATIONAL

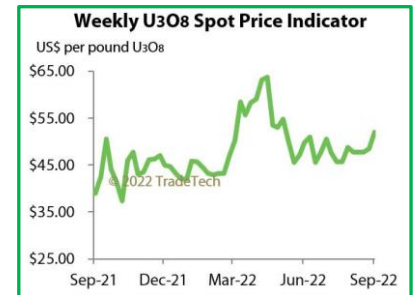
the international independent information and advice bulletin for uranium resource investments

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Overviews as at September 30, 2022



Marino G. Pieterse, publisher and editor



- ▶ **Spot and long-term U3O8 prices almost back to parity**
- ▶ **Future reactors under construction are almost totally for account of China and Russia**
- ▶ **Fourth generation focused on small nuclear reactors (SMRs)**

OVERVIEW of U3O8 PRICES

	Spot	Long-term		Spot	Long-term
2022					
September 30	52.00	51.50	▶ Year-end 2018	28.70	32.00
August 31	51.25	51.50			
July 31	47.75	51.50	▶ November 30 (high)	29.10	31.25
July 1	49.75	51.50	▶ October 29	27.95	31.25
May 31	47.75	50.75	▶ September 24	27.35	31.75
April 30	53.00	50.00	▶ August 27	26.20	31.50
▶ March 31 (high)	58.20	49.00	▶ July 31	25.70	31.50
February 28	48.75	43.88	▶ June 30	22.55	29.00
▶ January 31 (low)	43.08	42.88	▶ May 28	22.75	29.00
▶ Year-end 2021	42.05	42.75	▶ April 30 (low)	21.00	29.00
▶ November 29	46.00	43.00	▶ March 26	21.10	29.50
▶ October 29	45.20	43.00	▶ February 26	21.25	30.00
▶ September 30	42.60	42.50	▶ January 29	21.88	30.00
▶ September 17 (high)	50.50	34.25	▶ Year-end 2017	22.32	30.67
▶ August 31	34.25	34.25	▶ December 4 (high)	26.50	31.00
▶ July 30	32.50	33.50	▶ September 27	20.25	31.50
▶ June 28	32.10	33.50	▶ June 26	20.10	32.50
▶ June 18 (high)	32.50	33.50	▶ May 29 (low)	19.25	32.50
▶ April 30	28.90	33.75	▶ May 1	22.50	33.00
▶ March 26	30.50	33.75	▶ March 27	24.50	33.99
▶ February 26 (low)	27.98	33.75	▶ February 28	22.25	32.50
▶ Year-end 2020	30.40	35.00	▶ February 6	26.00	32.50
▶ November 30	29.35	35.00	▶ January 31	24.50	32.50
▶ October 30	29.70	35.00	▶ Year-end 2016	20.25	30.00
▶ September 30	30.00	35.00	▶ November 28 (low)	18.00	33.00
▶ August 31	30.85	35.00	▶ October 31	18.75	35.50
▶ July 31	32.70	35.50	▶ September 26	23.75	38.00
▶ June 30	33.20	35.50	▶ June 27	27.00	40.50
▶ June 1 (high)	34.25	35.50	▶ March 28	29.15	43.50
▶ April 30	33.20	32.50	▶ Year-end 2015	34.23	44.00
▶ March 30	27.35	32.50	▶ May 31, 2015 (high)	39.50	50.00
▶ March 20 (low)	23.95	32.50	▶ Year-end 2014	35.50	49.50
▶ February 21	24.70	32.50	▶ May 14, 2014 (low)	28.25	49.00
▶ January 31	24.45	32.50			
▶ Year-end 2019	25.00	32.50	▶ Year-end 2013	34.50	50.00
▶ November 29	26.05	32.50	▶ Year-end 2012	43.50	56.50
▶ October 31	24.85	31.50	▶ Year-end 2011	61.75	64.00
▶ September 30	25.80	31.00			
▶ August 30	25.30	31.50	▶ Pre-Fukushima accident		
▶ June 28	24.30	31.00	▶ March 11, 2011	67.75	73.00
▶ May 27 (low)	24.10	32.00			
▶ April 30	25.20	32.00			
▶ February 28	28.60	32.00			
▶ January 31 (high)	28.85	32.00			

source: UxC and Trade Tech; average month prices calculated by Cameco

WORLD NUCLEAR POWER REACTORS & URANIUM REQUIRED (as at September 2022)

Country	Reactors operable	Reactors under construction	Reactors planned	Nuclear electricity generation (TWh)	in % total generation	Uranium required 2021 (tonnes U)	% in uranium required
European Union							
▶ Western countries (7)							
France	56	1	0	363.4	69.0	8,233	
Belgium	6	0	0	48.1	50.8	790	
Spain	7	0	0	54.2	20.8	1,221	
Sweden	6	0	0	51.4	30.8	914	
Germany	3	0	0	65.4	11.9	521	
Finland	5	0	1	22.6	32.8	421	
Netherlands	1	0	0	3.6	3.1	69	
Subtotal	84	1	1	608.7		12,169	
▶ Eastern Europe (6)							
Czech Republic	6	0	1	29.4	36.6	706	
Slovakia	4	2	0	14.6	52.3	359	
Hungary	4	0	2	15.1	46.6	320	
Bulgaria	2	0	1	15.8	34.6	322	
Romania	2	0	2	10.4	18.5	185	
Slovenia	1	0	0	5.4	36.9	127	
Poland	0	0	6	0	0	0	
Subtotal	19	2	12	90.7		2,019	
▶ Total EU	103	3	13	699.4		14,188	
▶ Major nuclear power reactors outside EU							
USA	92	2	3	771.6	19.6	17,587	
China	54	22	38	383.2	5.00	9,563	
Russia	37	3	25	208.4	20.0	5,925	
South Korea	25	3	0	150.5	28.0	4,270	
India	22	8	12	39.8	3.2	977	
Canada	19	0	0	86.8	14.3	1,492	
Japan x	10	2	1	61.3	7.2	1,396	
United Kingdom	9	2	2	41.8	14.8	1,259	
Ukraine xx	15	2	0	81.1	55.0	1,876	
Subtotal	283	44	81	1,824.5		44,345	
x Japan's plan is to generate 20% of nuclear energy generation by 2030 from a depleted fleet since the Fukushima accident on March 11, 2011. Currently, 42 reactors are operable, with 10 having restarted since and 16 reactors currently in the process of restart approval							
xx Based on status before Russian invasion							
World total, of which:	436	47	96	2,653.0	10.3	62,496	
European Union in % world total	23.6	6.4	13.5	699.4	26	14,188	21.8
major countries outside EU in % world total	64.9	93.6	84.4	1,824.5	69	44,345	70.9

Notes: **Operable** = connected to the grid - 12.7% of total generation

Planned = approvals finding or commitment in place, mostly expected to be in operation within the next 15 years

The reference scenario in the 2019 edition of the Nuclear Fuel Report has 154 reactors closing by 2040 and 289 new ones coming online

source: WNA, Uraniumletter International

Top 10 global uranium producers by country <i>(September 2022)</i>			
Country	Production from mines <i>(tonnes U)</i>		in % world total <i>(tonnes U)</i>
	2021	2011	
Kazakhstan	21,819	21,317	45.1
Nambia	5,753	4,495	11.9
Canada	4,693	8,999	9.7
Australia	4,192	6,991	8.7
Uzbekistan (est)	3,500	3,500	7.3
Russia	2,635	2,872	5.5
Niger	2,248	4,667	4.7
China (est)	1,885	1,500	3.9
India (est)	615	385	1.3
Ukraine	455	960	1.0
Total Top 10	47,795	55,686	99.1
Total World	48,332	58,493	
Tonnes U3O8	56,995	68,974	
USA	8	1,537	
% of World total	0	2.9	
Total required uranium, including USA	62,496		
in % of World total	77		
Method tonnes U	32,088	66	
Inside leach (ISL)			
Underground & open pit (except Olympic Dam)	13,937	29	

source: WNA

World's largest uranium reserves <i>(in 1,000 metric tons)</i>		
		in %
Kazakhstan	304	24
Canada	275	22
South Africa	168	13
Brazil	156	12
China	102	8
United States	80 *	6
Mongolia	50	4
Ukraine	41	3
Tanzania	38	3
Uzbekistan	37	3
Russia	25	2
Total	1276	100

** based on estimates U.S. Energy Information administration (EIA) by mine and property status mining methods and states at the end of 2020*

► **European Commission declares nuclear energy and gas to be green**

To be considered as an essential part of solutions to lower global warming, the **European Commission** has tabled nuclear energy and gas as sustainable. Critics are calling the step “greenwashing” and say it could threaten the block’s bid to become climate-neutral by 2050.

European Commission Chief Ursula von de Leyen described the **European Green Deal** as “Europe’s man on the moon moment”. She has called climate neutrality “our European destiny” and she solemnly proclaimed that no effort will be spared for Europe to become the world’s first continent with net-zero emissions.

But the big question is how exactly the **European Union (“EU”)** intends to achieve its goals. One measure being put into place is a so-called taxonomy “a classification system establishing a list of environmentally sustainable economic activities”, according to the European Commission.

This taxonomy could be described as the EU’s green investment rule book, intended to serve the goal of allowing the continent to become climate neutral by 2050.

Critics on gas and nuclear to be green say the objective of climate neutrality could be under threat as the **European Commission**, the **EU**’s executive arm, decided to give nuclear energy and natural gas a green label under this taxonomy.

In a proposal presented on June 22, 2020 the **EU Commission** stated that certain strings remained attached. **For example, gas plants could only be considered green if the facility switched to low-carbon or renewable gases, such as biomass or hydrogen produced with renewable ENERGY BY 2035.**

Nuclear power plants would be deemed green if the sites can change to safely dispose of radioactive waste. So far, worldwide no permanent disposal site has gone into operation though.

Natural gas can be liquified, allowing it to be shipped relatively easy via tankers.

► **Vote EU Parliament Plenary session has saved inclusion of nuclear and gas in Taxonomy**

The two responsible committees objected on 14 June 2022 to the conclusion of nuclear and gas in the listing of environmentally sustainable economic activities. In a joint meeting of the Economic and Monetary Affairs Committee and the Environment Public Health and Food Safety Committee on June 14 MEPs adopted an objection to the Commission’s proposal to include specific nuclear and gas energy activities in the list of environmentally sustainable economic activities covered by the so-called **EU Taxonomy**, with 76 votes to 62 votes and 4 abstentions.

The Commission recognises the role of nuclear and fossil gas in guaranteeing stable energy supply during the transition of a sustainable economy. But, they consider that the technical screening standards proposed by the Commission in its delegated regulation to support their conclusion, do not respect the criteria for environmentally sustainable economic activities as set out in the **Taxonomy Regulation**.

The resolution adopted also requests that any new or amended delegated acts should be to a public consultation and impact assessments as they could have significant economic, environmental and social impacts.

Member states continue to be free to decide on their energy mix and investors continue to invest as they wish, as there is no obligation to investors to invest solely in economic activities that meet specific criteria.

The Parliament and Council had until 11 July 2022 to decide whether to veto the Commission’s proposal, was objected by an absolute majority of 353 votes, and was withdrawn by the Commission.

► **EU “Green Deal” plan not feasible due to familiar controversies on the acceptance of nuclear as a clean energy source**

The overview below demonstrates that of the total number of 106 reactors operable, 87 are located in Western countries and 19 in Eastern European countries.

Looking ahead, only 2 reactors are under construction and one reactor is planned. For **Eastern Europe** these numbers are 2 and 6, respectively.

Furthermore, the overview attracts attention because of **Germany** and **Belgium** having decided to phase out nuclear energy, they are confronted with the impact of a strong increase of gas prices, which might lead to a change

in strategy. From such a perspective it is also to be noticed that **the Netherlands** having turned against nuclear since having built only one operating reactor since 1973, is recently searching the options for building a second big reactor and two small reactors.

As neighboring countries they should go for a joint strategic block, which would save the expenditure of billions of Euros compared to operating apart.

► **Nuclear Renaissance France**

Having won the elections in a fractious campaign, **French President Emmanuel Macron**, who ran on a ticket to boost nuclear and renewable energy, has planned a nuclear renaissance and green transition targeted on solar capacity.

The president has planned to build **6 European pressurised reactors (EPRs)** by 2050, with an option for eight more pending further assessment, he stated in his election manifesto. The construction of the first reactor would start in 2028 and come into service in 2035, though the plan was deemed “unrealistic” by some experts.

President Macron also scrapped a plan to close 12 reactors by 2035 in a U-turn to his 2017 campaign pledge to cut reliance on nuclear energy to 50%, down from 70% currently.

Macron has actually requested state-owned operator EDF study the feasibility of prolonging reactor lifespans beyond their statutory 50 years, in light of predictions power demand would rise 60% by mid-century .

Macron also proposed investments of up to EUR billion by 2030 in developing small modular reactors, though these were still at a prototype stage.

In terms of renewables, the president pledged a 10-fold increase in planned solar capacity to 100 GW by 2050 and an increase in offshore wind to 40 GW over the next 30 years.

However, he reduced targets for onshore wind power to 37 GW by mid-century, instead of 34 GW by 2030, in a move to appease growing opposition to turbines.

Industry lobbies and experts have warned that curbing the growth of onshore wind power would put the country’s security of supply at risk, however. Renewables lobby SER insisted the success of Macron’s programme “largely depended on the means which will be mobilised to meet the challenges”.

France had systematically lagged behind its wind and solar power targets due to a lack of political will in the face of public opposition, the group said.

The French leader, along with his **Greek, Italian** and **Spanish** counterparts, was calling for reform of Europe's wholesale electricity market to decouple electricity prices from gas prices, which have skyrocketed following Russia's invasion of Ukraine. However, the European Commission and a majority of EU member states believed the current "marginal pricing" system was “effective”.

Macron also announced at the end of March he would nationalise utility EDF, which is currently 84% state owned, to finance the costly nuclear revival.”

► **Germany is struggling to unbundle its energy dependence on Russia**

While **Germany** is struggling to unbundle its energy dependence on Russia, Bunds Chancellor Olaf Scholz (Social Democrat) has nixed a possible proposal to prolong the phase-out of nuclear reactors initially due to cease by the end of the year, out forward by Finance Minister Christian Linder (FDP), who said to have talked about the question of energy supply in a non-ideological way and adding that Germany has safe nuclear power plants.

However, Linder's statement contradicted the German plans to phase-out nuclear by the end of 2022, with Chancellor Scholz emphasizing that the government would stick to the plans to phase-out nuclear energy and refuted the finance minister's arguments. Further investment in nuclear energy would make no sense as the building of a new nuclear reactor would cost up to € 18 billion and a new power plant would only be operated by 2037 or 2038 – a time frame where the government already expects to be completely independent of Russian gas imports.

Meanwhile, the German population is increasingly in favour of prolonging the run time of nuclear. According to a recent survey by INSA, 50% of the Germans said that they would welcome a prolongation of nuclear power plants amidst an energy crisis triggered by the Ukraine.

► **Germany's gas crisis due to the cut-off of Russian gas urges extending life of remaining three nuclear power plants**

Falling Russian gas supplies in Germany through the Nord Stream 1 pipeline have emboldened pro-nuclear voices in Germany and Europe ahead of feared electricity crunch this winter. The economic ministry said power grid operations had requested a second assessment of the viability of nuclear power.

"We will now calculate again and then make a decision on the basis of clear facts", a ministry spokesperson said, adding the results of the new evaluation were expected in a few weeks. Members of the conservative CDU/CSU opposition block have blamed the Green party, which runs the economy ministry, for gas supply outages the government's resistance to changing back on the issue saying this was purely ideological.

But deputing government spokesperson Hoffman said the question of extending the terms was a technical one for the government, not an ideological one.

The new assessment will consider the potential impact of higher gas prices on electricity prices more seriously and a halt in French nuclear power plants production, an economy minister document seen by Reuters showed.

The stress test will also consider the special situation in southern Germany and in the state of Bavaria, where Isar II nuclear power plant, one of the remaining nuclear power plants, is due to be shut at the end of the year. The state depends on gas-fired power plants and as few coal-fired plants and low wind power production, it added. The three plants made up 6% of Germany's power production.

Bavaria's Economy Minister Hubert Aiwanger on July 17 urged the deferral government to extend the lifetime of the nuclear power plants. When the Greens say that "nuclear power cannot be used to heat an apartment or that we do not have an electricity problem, but a gas problem" then that is complete nonsense, Aiwanger told the Ausburger Allgemeine newspaper.

► **Germany Chancellor Olaf Scholz has managed to get the G7 countries to support his push for a "climate club"**

In 2021, the finance minister Olaf Scholz put forward his ambition to form a club of "ambitious, bold and cooperative countries". **The initiative's targets were especially China and the US, important EU trade partner countries with a price on CO2 emissions, and those with a large industrial sector.**

Now chancellor, he has managed to wrangle the G7 countries into agreeing.

"We need more ambition to achieve our climate goals. With the climate club we are helping to ensure that we can also meet this commitment" explained Scholz during his final remarks at the G7 summit in Ellmau, Austria on 28 June 2022.

In the final statement of some of the world's largest industrial countries, they highlight that the G7 "aim to establish a climate club with "a particular focus on the industry sector" by the end of 2022.

► **Poland plans to deploy up to 6 nuclear reactors by 2040**

On December 30, 2021, it was announced that the Polskie Elektrownie Jadrowe (PEJ) – Polish Nuclear Power Plants), the government company responsible for plans to deploy **up to 6 reactors at multiple sites by 2040**, has selected the coastal location of Lubiatowo-Kopalino in the Choczewo commune in Poverania near Wyherowo for the first reactor.

In the first quarter of 2022, an environmental impact statement will be submitted to the General Director of Environmental Protection. The **Energy Policy assumes that the first nuclear power plant unit will be put into operation in 2033**.

'We are operating as planned and the choice of location confirms this. Poland needs nuclear energy, and the construction of the first power plant of this type in Poland is important for the entire country, both in terms of energy transformation and security of energy supply', said Anna Moskwa, Minister of Climate and Environment.

The study initially investigated 92 potential sites that were assessed on "factors such as land characteristics, cooling water available, location in relation to areas covered by forms of nature protection, including **Natura 2000** sites, and existing and expandable infrastructure elements, such as energy road and rail networks", **PEJ** noted.

Natura 2000 is a coordinated network of protected habitats within the European Union.

Under the Polish Nuclear Power programme **Poland** plans to build modern but proven and large pressurized water reactors. The **Polish Energy Policy 2040 assumes that in 2033 the first unit with a capacity of between 100 Mwe and 1600 Mwe will begin operation**. The next units will be implemented every two of three years.

The programme involves the construction of 6 units with a capacity of up to 900 Mwe. The Polish government expects that any partner in the programme will take up 49% share in a special company and will provide adequate financing and will participate not only in the construction but also in the operation of the plants.

► **Nuclear energy from US and France will cut Czechia's dependency on Russia**

On April 18, 2022, the **Czech Republic** announced that it is advancing on its quest to add more nuclear energy, decade-long reliance on Russia seems to be diminishing in the long term. State-controlled energy group **Čez** selected French **Framatome** and American **Westinghouse** to build a new reactor unit at the Dukovany nuclear power plant, one of two reactor sites currently in operation.

Yet, finding the suppliers is only a step in a long process. The 15-year contract will be signed in 2024, and construction is to begin in 2029. The deal is worth billions of Czech crowns (US\$ = 23.35 Czech crowns) said **Čez Group** Chief spokesman Ladislav Kriz. In December 2023, **Čez** should give the government a final assessment of the bids, according to **Čez** director general Daniel Beneš.

The current supplier of the plant is **Russian TVEL**, which is part of Russian energy giant **Rosatom**, but together with **China's CNF** was excluded from the tender as companies might pose a potential security risk. A law signed by President Miloš Zeman in September 2021 blocked both Russia and China from future participation in nuclear projects.

Čez said it selected the US and France nuclear power companies so that it could reliably ensure a continuous supply of fuel cells for Temelin's reactors, while "minimizing the risks if a possible supply outage".

The **Czech Republic** already relies in 6 nuclear reactors to generate more than a third of its total electricity. Besides the 2 plants in **Temelin**, **Čez** operates another 4 510-megawatt units at the Dukovany power plant.

Prime Minister Petr Fiala said the **Czech Republic**. "Our dependence in fossil fuels from Russia, neglected for years, is one of the greatest security risks to our country", he said. "It should be our goal to escape the Russian energy noose completely in the next 5 years". At the same time, the **Czech Republic** meets its gas needs almost entirely through shipments directly or indirectly from Russia and gets roughly half of its crude exports from the same source.

Unlike its Western neighbours **Austria** and **Germany**, the **Czech Republic** is doubling down on nuclear power and also renewable energy sources after deciding to phase out coal as a fuel for energy generation by 2033 to reduce carbon emissions.

► **Russian invasion in Ukraine wake-up call for Europe to diversify its energy resources and reinforce its energetic autonomy**
Review call for nuclear energy to be included

On May 26, 2022, it was announced that 20 major trade unions from across Europe representing employees in the energy sector have renewed their call for European politicians to include nuclear energy in the block's sustainable finance taxonomy.

The unions, from **Belgium Bulgaria, the Czech Republic, Finland, Hungary, Lithuania, Romania, Slovakia and Slovenia**, said in a joint letter to members of the European parliament that they should vote in favor of – or at least not oppose the complimentary delegated act - providing for the inclusion of nuclear an gas in the taxonomy.

The taxonomy became law in July 2020, but legislation left important details to be resolved through complementary delegated acts - secondary legislation meant for technical issues that is not subject to the same degree of mistrial and parliamentary oversight.

The unions said nuclear energy should be included in the taxonomy on the basis of science evidences and the aim of the taxonomy to be “technology neutral”. The unions said nuclear has a keynote in enabling Europe to achieve carbon neutrality.

“For the employees of the electricity and gas industries, the inclusion of nuclear and gas in the European taxonomy is of primary importance for diversifying energetic supplies and increasing justice, for economic sustainability and for the future of their jobs in an essential industrial and service sector”, the letter said.

The unions said the EU cannot afford to deprive itself of proven and available low-carbon solution if it wants to achieve its climate neutrality objective and not lose the leadership battle to the US and other states.

► **U.S. seeks \$ 4.3 billion to support a plan to buy enriched uranium directly from domestic producers**

On June 7, 2022, the Biden administration announced that it is pushing lawmakers to support a \$ 4.3 billion plan to buy enriched uranium directly from domestic producers to wean the U.S. from Russian imports of the nuclear-reactor fuel, according to a person familiar with the matter.

Energy Department officials have met with key professional staff where they said such funding is urgently needed, said the person, who wasn't authorized to publicly discuss the information. Energy officials made the case that any interruption in the supply of enriched Russian uranium could cause operational disruptions at commercial nuclear reactors, the person said. It would create a government buyer directly purchasing enriched uranium, including the type used in a new breed of advanced reactors now under development.

US nuclear energy industry participants have also briefed on the proposal, said a second person familiar with the details, which led to a uranium share surge. Still, it won't be easy for the US to jump-start the domestic uranium industry. The country has only one remaining commercial enrichment facility – a new Mexico plant owned by Urenco, a British-German-Dutch consortium.

The talks come as the Biden administration contemplates slapping sanctions on enriched uranium imports from Russia in response to the Russian invasion of Ukraine while considering prospects that the country could also decide to halt imports.

Russia accounted for 15.5% of the uranium imported into the US in 2020 and 23% of the enriched uranium needed to power U commercial nuclear reactors.

Energy Secretary Jennifer Coranholm has called the US reliance on Russian imports “a vulnerability for national and economic security, while drawing attention to the fact that US enrichment capacity has waned in part because of competition from state-subsidized resources”

► **China** plans to increase **nuclear power generation** capacity significantly in its economic and development goals for the 5 years plan 2021-2025

China has set up a national nuclear safety standardization technical committee as it aims to increase use of nuclear power under its efforts to be carbon neutral by 2060. The government last year set a target that China's carbon dioxide emissions should peak by 2030, with nuclear energy expected to play a significant role in reaching this as well as the 2060 goal.

In **China's latest 5-year plan (2016-2020)**, which set out China's economic and development goals, the country said it aimed before 2025 to raise nuclear power generation to 70 gigawatts, which would be an increase of 27% from last year's 51 GW. The country failed to meet its nuclear energy targets under the previous 5-year plan during which it had suspended approvals for new nuclear power stations in 2011 after the Fukushima Daiichi nuclear disaster in Japan.

The committee will establish "a strict and huge nuclear safety standard and further improve the level of legislation of nuclear safety", including nuclear power plant safety, nuclear material safety and radioactive waste safety.

The national nuclear safety standardization technical committee will have 42 members, who will include representatives drawn from the nuclear safety supervision department, the nuclear energy industry's authority department, nuclear power enterprises research institutes and universities.

Guo Chengzhan, the deputy administrator of the National Nuclear Safety Administration, has been named as the director of the committee. Ye Qizhen and Du Xiangwan, respectively an academic and former vice-president of the Chinese Academy of Engineering, will serve as deputy directors. The committee secretariat will become a department of the ministry.

► **Prime Minister Kishida of Japan** hints at further use of nuclear power as energy prices sour due to Russia's war in Ukraine

On April 12, 2022, behind Mr. Kishida's move are growing concerns over how to ensure stable electricity supply following the government's decision to phase out Russia coal in stages as part of its sanctions on Moscow. Russia accounts for 11% of Japan's total coal imports.

"Nuclear power is a baseload power source needed for decarbonization and is important in terms of stable (energy) supply", Kishida told a plenary meeting of the House of Representatives, the lower chamber of parliament on March 31.

With coal prices souring the Russian coal phaseout will almost certainly affect citizen's lives. Meanwhile, it is difficult to rapidly expand the use of renewable energy sources, where outputs swing dependent on the weather, giving the high costs to build related facilities.

In March, the government issued its first power shortage warning in the service areas of Tokyo Electric Power Company Holdings (Tepco) and Tohoku Electric Power to prevent a huge blackout caused by a lack of power. The shortage largely stemmed from a special factor, namely suspensions of thermal power plants following a major earthquake off the northeastern prefecture of Fukushima on March 16. But the warning caused anxiety among the public over the country's power supply capacities.

According to its basic energy plan, drawn up in October last year, the government aims to raise the share of nuclear power to 20-22% of the country's total power generation in fiscal 2030 from only 3.9% in fiscal 2020.

Ten of the country's 36 domestic nuclear reactors still in use have restarted operations since the March 2011 earthquake and tsunami, which triggered a nuclear accident at Tepco's Fukushima No. 1 power plant. Currently, only five of them are in operation, including the No. 3 reactor at Kansai Electric Power's Oi nuclear plant in Fukui Prefecture.

The ruling Liberal Democratic Party said in a draft proposal of emergency economic measures penned April 11 that Japan “will make the most use of various power sources to secure stable electricity supply.”

There is “no change” in the government’s policy of approving resumptions of nuclear power plant operations when the Nuclear Regulation Authority confirms that the facilities meet its new safety standards, Chief Cabinet Secretary Hirokazu Matsuno told a news conference the same day.

On August 24, 2022, the Japanese business daily Nikkei reported that the government, led by Prime Minister Fumio Kishida, is going to consider developing and constructing next-generation nuclear power plants, a departure from its previous stance of not building new reactors, thereby setting the stage for a major policy shift on nuclear energy a decade after the Fukushima massive earthquake and tsunami in March 2011, triggered by a meltdown at Daiichi power plant.

The comments from Mr. Kishida – who also said the government would look at extending the life span of existing reactors – highlight how the Ukraine crisis and soaring energy costs have forced both a change in public opinion and a policy rethink toward nuclear power.

Japan needs nuclear power because its grid is not connected to neighbouring countries, not is it able to boost output of domestic fossil fuels.

As of late July, Japan had 7 operating reactors, with 3 others offline due to maintenance. Many others are still going through a relicensing process under stricter safety standards imposed after Fukushima.

Under current regulation Japan decommissions plants after a predetermined period, which in many cases is 60 years.

Small Modular Reactors (SMRs)

► US, Japanese firms agree to cooperate on fast reactors

The Japan Atomic Energy Agency (JAEA), Mitsubishi Heavy Industries (MHI) and Mitsubishi FBR Systems (MFBR) on January 26, 2022 signed a Memorandum of Understanding (MoU) with TerraPower of the USA to cooperate on the development of sodium-cooled fast reactors. TerraPower - founded by Bill Gates - is developing the Natrium sodium-cooled fast reactor.

JAEA said Japan aims to accelerate innovations in various nuclear technologies in collaboration with the development of next-generation innovative reactors overseas. **"As part of this, with the support of the US Department of Energy (DOE), the United States, which is trying to lead the world by starting the development of a fourth generation reactor including a sodium-cooled fast reactor under its Advanced Reactor Demonstration Program (ARDP), we are trying to promote fast reactor development cooperation."**

"Focusing on manufacturing technology, JAEA, MHI, MFBR and TerraPower have exchanged information on each other's technologies, as well as technologies unique to sodium-cooled reactors, including refuelling machines and damaged fuel detection systems," **JAEA** said.

"As a Japanese industry, we will utilise the knowledge of **Hitachi-GE Nuclear Energy, Toshiba Energy Systems, Fuji Electric**, etc. involved in the construction of Joyo in Haraki Prefecture and Monju in Fukui Prefecture and consider participating in cooperation," **JAEA** added.

TerraPower has been selected by **DOE** to receive cost-shared funding through the ARDP programme to test, licence and build an advanced reactor within the next seven years.

► Milestone for UAMPS NuScale small modular nuclear reactor plant

Field activities at the Carbon Free Power Project (CFPP) site have been completed in what Utah Associated Municipal Power Systems (UAMPS) has described as a major milestone for the project to build a NuScale small modular reactor plant at the Idaho National Laboratory.

UAMPS expects to build six 77 MWe NuScale Power Modules - renamed VOYGR by NuScale late last year - at the Idaho National Laboratory site. The pressurised water reactor, with all the components for steam generation and heat exchange incorporated into a single unit, is the first SMR to receive NRC design approval.

Analysis of the data collected from the site, as well from as a two-year monitoring campaign, will be presented in the combined licence application (COLA) which is being prepared for submission to the **US Nuclear Regulatory Commission (NRC)**.

Preparation of the application, which is being managed by Fluor Enterprises under contract with CFPP, with support and technical expertise from **NuScale Power**, is scheduled for completion in early 2024, and start-up operation of the plant is planned for 2029.

UAMPS is a political subdivision of the State of Utah that provides wholesale electric-energy, transmission, and other energy services to community-owned power systems throughout the Intermountain West region of the USA. Its members are located California, Idaho, Nevada, New Mexico and Wyoming as well as in Utah.

► Development of British small nuclear plants can deliver low-cost, low-carbon reliable Energy production

In a study entitled “**UK SMR: A National Endeavour**” issued in September 2017 by **Rolls-Royce** and its partners in a **UK Small Modular Reactor (SMR)** consortium, it was said that the UK industry has once in a lifetime opportunity to provide secure, reliable and affordable power for decades to come.

The study urges Ministers to support the development of British-manufactured small nuclear plants, which can deliver low-cost, low-carbon electricity, which could create 40,000 skilled jobs, contribute £ 100 billion to the economy and open up a potential £ 400 billion global export market.

The report argues that “through its innovative approach to modular construction” the **UK SMR programme** is uniquely placed to avoid the complexities, delay and oversteps often associated with infrastructure projects.

Highlighting the importance of delivering security of supply as decarbonisation and electric vehicles look set to increase, electricity demands from consumers, the study paints out that just one SMR can power a city the size of Leeds, charge more than 62,000 electric cars or keep 88 million smartphones operational.

Harry Holt, President-Nuclear, Rolls-Royce, said “The UK has never had a greater need for low-cost, low-carbon, safe secure and reliable energy production. With demand for energy set to rise in the near future – in part due to the growing popularity of electric cars – we believe the UK SMR programme is a vital addition to our national infrastructure”.

“It represents a once in a lifetime opportunity for UK companies to design, manufacture and operate next generation reactors to meet our energy challenge, bolster the Government’s Industrial Strategy, bring jobs and growth to our economy and provide valuable post-Brexit exports”

U.K. Prime Minister Boris Johnson said nuclear power plants need to play a larger role as Europe tries to move away from dependency on Russian oil and gas.

On May 2, 2022, Boris Johnson, visiting England’s Hartlepool nuclear power station, said the country will build one new nuclear plant. “Instead of a new one every decade, we are going to build one every year, powering homes with safe and reliable energy”, the British Prime Minister said of nuclear power status.

**With 15 operable reactors, the U.K. has, next to France with 15, the highest number of operable nuclear reactors and has 2 reactors under construction and 2 reactors planned.
In 2021, nuclear electricity provided 51% of the country's total electricity generation (TWh).**

► **Rolls Royce sees U.K. approval for mini nuclear reactor by mid-2024**

On [April 19, 2022](#), **Rolls Royce** said that its design for a small modular nuclear reactor should receive U.K. regulatory approval by mid-2024 and be able to produce grid power 5 years later, Paul Stein, chairman of Rolls Royce Small Modular Reactors, told Reuters on April 19, 2022.

"We are trying to work with the U.K. government and other to get going new placing orders so we can get power on grid by 2029", Stein said, adding that in the meantime **Rolls Royce** will start manufacturing parts of the design that are most likely to change.

► **US regulators discuss smaller SMR emergency zone**

The **US Regulatory Commission (NRC)** has concluded that **Tennessee Valley Authorities' (TVA)** methodology can be used in the future to determine if a reduced emergency planning zone is justified for small modular reactors, a spokesman for the commission told World Nuclear News. It is not just agreed that an EPZ around small modular reactors can be scaled to reflect their reduced risks rather than the mandatory 10-mile EPZ required for the USA's current high-water reactor fleet.

The **NRC** is working on a safety evaluation of a 2016 Early Site Permit application from the **TVA** for the potential use of a site at Clinch River for two or more SMR modules of up to 800 MWe. This is the first SMR-related application of any type to be received by the NRC. However, it is premature to say any conclusions have been reached regarding any SMR design having met the conditions for a reduced EPZ.

No exemptions have been granted since the Clinch River ESP review is still underway, Scott Burnell, public affairs officer at the NRC, told World Nuclear News.

TVA's application uses information from [four SMR designs](#) – **BWXT's mPower, Holtec International's SMR-160 NuScale Power's SMR and Westinghouse's SMR – to provide the technical basis for a requested exemption to the 10-mile EPZ requirement currently in use.**

The most detailed information was provided on the **NuScale SMR**, for which a design certification application was submitted by the NRC in January 2017. **NRC staff found TVA's proposed dose-based, consequence-oriented methodology to be a "reasonable, technical basis" for determining EPZ size, consistent with the basin used to determine that for large water reactors, NEI said.**

► **Vattenfall begins feasibility study on construction on SMR's at Ringhals**

Electricity consumption in **Sweden** is expected to increase rapidly over the coming decade and, for this reason, **Vattenfall** is working actively to find out how different fossil-free energy sources can satisfy the increased demand for electricity. **As part of this work Vattenfall is now initiating a feasibility study looking at the conditions for building at least two small modular reactors (SMR's) adjacent to the Ringhals nuclear power plant.**

"We will need all fossil-free energy sources to meet the increasing demand for electricity in Sweden. SMR is a fossil-free technology that come a long way in recent times, so we want to investigate the conditions for building small modular reactors in the vicinity of Ringhals nuclear power plant", says CEO Anna Borg

"No investment decisions have been made but, during the spring Vattenfall's management team has been working on the issue of new nuclear power in Sweden. Provided that a feasibility study concludes that it would be preferable and all other conditions for future investment decisions are met, in particular, new regulations for nuclear power, it should be possible to have the first SMR reactor by the early 2030s, says Anna Borg.

“Ringhals is a suitable location for new nuclear power for several reasons. On the one hand, we are allowed to replace the two shutdown reactors [Ringhals 1](#) and [Ringhals 2](#) within the existing legislation, and on the other hand there is already grid infrastructure in place that makes connecting new electricity generation simpler.

There is also a lot of acceptance for both existing and new nuclear power at **Ringhals** and **Forsmark**. “One major advantage is also the comprehensive skill level available at Ringhals”, said Forbjörn Wahlborg, head of Business Generation at Vattenfall.

Vattenfall has already invested in a number of fossil-free energy sources, primarily [wind power](#), [hydropower](#) and [technology for energy storage](#) in the form of [hydrogen gas](#).

► **President Biden signed bill package of \$ 740 billion to transform US energy to combat climate change**

On [August 16, 2022](#), signing of the **Inflation Reduction Act (IRA)**, which should provide further impetus for growth of U.S. renewable energy. The IRA came of the heels of a report from the [Federal Regulatory Commission \(FERC\)](#) that installations of solar and wind power accounted for more than two-thirds of new domestic utility-scale generation in the first six months of the year.

Signing of the bill, which passed both the U.S. Senate and House along party lines earlier in August– all Democrat’s supported the bill and climate projects. The bill, a \$ 740 billion package in total, is considered the most significant U.S. investment ever to combat the effects of climate change, with a goal of reducing carbon emissions -mostly from power generation and transportation by at least 40% or \$ 296 billion by 2030.

Part of the carbon reduction efforts involves nuclear energy. There are key provisions in the IRA that support nuclear, said Judi Greenwald, executive director of the Nuclear innovations Alliance, including:

- Two technology-neutral clean electricity tax credits that include advanced nuclear energy as an eligible zero-emitting energy source: a production tax credit ([PTC](#)), and an investment tax credit ([ITC](#)). A nuclear project developer can elect either tax credits based on their specific project needs.
- An investment tax credit ([ITC](#)) and production tax credit ([PTC](#)) for clean hydrogen production that includes hydrogen produced using nuclear energy.
- [Federal funding of \\$ 700 million to help make high-assay low-enriched uranium \(HALEU\)](#) available for advanced reactor demonstration and commercialization through public and private partnerships and actions. This funding will catalyze the creation of a commercial HALEU market.

Peer Group of the world's top-20 listed Uranium Companies

September 30, 2022	Trade symbol		Share price		Change in %	12 months		Market cap. million	
			Sept.30 2022	Year-end 2021		H	L	local	US\$
Kazakhstan (1)									
			US\$	US\$		US\$	US\$	US\$	US\$
Kazatomprom	LSE	KAP:LI	25.18	36.75	-31	49.55	22.05	6,534.2	6,534.2
Canada (9)									
			C\$	C\$		C\$	C\$	C\$	US\$
Cameco	1) TSX	CCO	36.66	27.58	33	41.05	23.03	14,606.8	10,663.0
NexGen Energy	2) TSX	NXE	5.02	5.54	-9	8.30	4.43	2,407.2	1,757.3
Denison Mines	TSX	DML	1.61	1.74	3	2.64	1.19	1,317.8	962.0
Global Atomic *	3) TSX.V	GLO	3.48	4.19	-17	5.10	2.58	618.2	451.3
Fission Uranium	TSX	FCU	0.66	0.78	-15	1.25	0.56	449.8	328.4
IsoEnergy	4) TSX.V	ISO	3.95	3.74	6	6.53	2.51	422.0	308.1
enCore Energy *	5) TSX.V	EU	3.57	1.60	123	6.30	2.91	383.4	279.9
GovEx Uranium *	TSX.V	GXU	0.23	0.36	-35	0.52	0.21	136.3	99.5
Sub-total									14,849.5
United States (4)									
			US\$	US\$		US\$	US\$	US\$	US\$
Uranium Energy	6) AMEX	UEC	3.50	3.35	4	6.60	2.34	1,170.0	1,170.0
Energy Fuels	7) NYSE MKT	UUUU	6.12	7.63	-20	11.39	4.69	964.4	964.4
Ur-Energy	NYSE MKT	URG	1.53	1.22	25	2.72	1.26	340.9	340.9
Peninsula Energy	NYSE OTC	PENMF	0.10	0.14	-29	0.24	0.08	99.9	99.9
Sub-total									2,575.2
Australia (6)									
			A\$	A\$		A\$	A\$	A\$	US\$
Paladin Energy	8) ASX	PDN	0.78	0.88	-12	1.04	0.53	2,300.0	1,495.0
Boss Energy	9) ASX	BOE	2.53	2.25	12	3.10	1.61	892.0	579.8
Energy Resources of Australia	ASX	ERA	0.21	0.34	-38	0.45	0.16	775.2	503.9
Deep Yellow *	10) ASX	DYL	0.85	0.86	-2	1.26	0.55	618.2	401.8
Lotus Resources	ASX	LOT	0.23	0.31	-26	0.46	0.19	305.0	198.2
Bannerman Energy	ASX	BMN	1.98	2.65	-25	4.35	1.50	296.2	192.5
Sub-total									3,371.2

* featured as a **Special Situation** and included in Shortlist of investment recommendations

► **Total market capitalization top listed uranium companies - September 30, 2022: US\$ 27.330.1 million**

- 1) resumed production at Cigar Lake; expects to produce up to 12 million pounds U3O8 on a 100% basis in 2021; sales/delivery volume uranium 23 to 25 million pounds U3O8
- 2) holds 53% in Iso Energy from spin-off
- 3) also 49% interest in producing zinc project in Turkey
- 4) announced on September 8, 2020 the acquisition of all of Westwater Resources' United States uranium assets in enCore shares; announced on September 7, 2021 the acquisition of Azarga Uranium
- 5) 53% held by Nexgen Energy
- 6) acquisition of UEX completed on August 22, 2022
- 7) combined uranium-vanadium project
- 8) holds 75% interest in flagship uranium-vanadium Langer Heinrich Mine in Namibia; CNNC of China holds 25% interest;
- 9) also assets in Canada and Australia; sold 85% interest in uranium mine in Malawi to Lotus Resources
- 10) acquisition of Vimy Resources valued at US\$ 493 million effective July 27, 2022; completed on August 5, 2022

MARKET VALUATION OF THE WORLD'S LISTED URANIUM PRODUCERS and STANDBY PRODUCERS

(in US\$ million)

Country focus	Company Name		Sept.30 2022	Year-end 2021	Change % 2022 / 2021	Year-end 2020	Year-end 2019	Year-end 2018	Year-end 2017	Year-end 2016	Year-end 2015	Year-end 2014	Year-end 2011	Year-end 2010	Change % 2020 / 2010
Kazakhstan	Kazatomprom	1)	6,534.2	6,821.9	-4	3,306.4	3,372	3,530							
Canada	Cameco	2)	10,663.0	8,563.1	25	5,264.4	3,508	4,491	3,630	4,112	4,865	6,477	7,306	15,866	-67
United States	Uranium Energy	3)	1,170.0	895.3	31	350.4	169	222	276	132	105	160	253	421	-17
	Energy Fuels	4)	964.4	1,190.0	-19	558.5	189	255	133	109	134	121	167	158	253
	Ur-Energy	5)	340.9	263.5	29	135.9	94	104	99	76	138	110	96	303	-55
	Peninsula Energy	6)	99.9	141.6	-29	97.4	33	36	81	75	85	113	122	158	-38
Australia	ERA	7)	503.9	941.7	-46	877.8	62	91	367	164	136	549	663	2,165	-59
Namibia	Paladin Energy	8)	1,495.0	1,620.6	-8	432.6	142	230	67	111	300	489	1,118	3,649	-88
	Total		21,771.3	20,437.7	7	11,023.4	7,569	8,959	4,653	4,779	5,763	8,019	9,725	22,720	-51
	U3O8 spot price		52.50	42.10	25	33.40	25.00	28.70	22.32	20.25	34.23	35.50	51.75	62.50	-47
	U3O8 long-term price		53.00	43.00	23	35.00	32.50	31.25	30.67	30.00	44.00	49.50	64.00	65.00	-46

1) listed on London Stock Exchange) as at November 16, 2018 through an IPO offering of 15% of the Company's outstanding shares at a price of US\$ 11.60

2) producer; suspended production McArthur Lake, began in February 2018 and Cigar Lake on April 13, 2020; resumed production at Cigar Lake in Q2 2021; expects to produce up to 12 million pounds U3O8 on a 100% basis in 2021

3) ISR production commencement in November 2010; stopped production since 2014; stand-by producer

4) stand-by producer; also vanadium recovery operations from company's White Mesa Mill, Utah

5) ISR production commenced in August 2013

6) first ISR production commenced in December 2015

7) producer; A\$ 476 million fully underwritten renounceable entitlement offer closed successfully on February 18, 2020

8) stand-by producer; CNNC Overseas Uranium Holding of China holds 25% equity interest; in flagship Langer Heinrich Mine; also assets in Canada and Australia; sold 85% in Kavalekera Mine, Malawi to Lotus Resources; 15% owned by Malawi government

MARKET VALUATION OF THE WORLD'S MOST ADVANCED LISTED URANIUM DEVELOPMENT COMPANIES

(commercial production target <5 years)

(in US\$ million)

Country focus			Sept. 30 2022	Year-end 2021	Change % 2022 / 2021	Year-end 2020	Year-end 2019	Year-end 2018	Year-end 2017	Year-end 2016	Year-end 2015	Year-end 2014	Year-end 2011	Year-end 2010	Change % 2020/2010
Canada	Denison Mines		962.0	1095.7	-12	444.1	247.7	272.1	305	276	261	491	464	1,248	-64
	UEX		153.3	155.6	-1	91.7	43.9	48.9	89	54	27	58	145	456	-80
Australia	Boss Energy	1)	579.8	446.0	30	124.0	55.7	66.8	42	38	-	-	-	-	
Namibia	Deep Yellow *	2)	4018.0	244.4	1544	94.5	50.1	55.8	48	37	9	22	89	379	-75 x
Niger	Global Atomic *	3)	451.3	564.5	-20	188.2	53.6	40.7	-	-	-	-	-	-	x
	GoviEx Uranium *	4)	99.5	158.4	-37	85.3	52.0	43.5	70	35	5	39 *	-	-	
	Total		6,263.9	2,664.6	135	1,027.8	503.0	527.8	554	440	302	610	698	2,083 x	-73

* featured as a **Special Situation** and included in **Shortlist of investment recommendations**

x not included in year total

* listing date June 20, 2014

1) also nickel-copper project and gold project in Sweden

2) acquisition of Vimy Resources valued at US\$ 493 million effective July 27, 2022; completed on August 5, 2022

3) also 49% interest in operating zinc project in Turkey

4) acquired African uranium assets in Zambia, Mali and Namibia from Denison Mines in consideration of 25% of GoviEx' shares; current equity interest 18.65%

Geographic overview of the world's highest valued uranium exploration and development companies

Traditional countries (21)

(market capitalization in million as at September 30, 2022)

Canada (11)	C\$	United States (6)	US\$	Australia (4)	A\$
NexGen Energy	2,407.2	Encore Energy	1) 279.9	Boss Energy	1) 892.0
Denison Mines	1,317.8	Consolidated Uranium	2) 112.7	Alligator Energy	178.3
Fission Uranium	449.8	Laramide Resources	3) 75.2	Havilah Resources	96.6
Iso Energy	1) 422.0	Western Uranium & Vanadium	37.2	Energy Metals	32.5
UEX	2) 210.0	Anfield Energy	4) 27.3		
Baselode Energy	68.3	Okapi Resources	21.6		
Skyharbour Resources	67.1				
CanAlaska Uranium	53.0				
Fission 3.0	25.7				
Purepoint Uranium Group	24.1				
	A\$				
92 Energy	46.2				

notes Australia:

1) also nickel-copper project in Sweden and gold project in Senegal

notes US:

- 1) see Peer Group under note 5 on page 7
 2) announced on July 15, 2021 the acquisition of uranium projects in Utah and Colorado, US from Energy Fuels
 3) also uranium projects in Australia
 4) also precious metals development

- 1) 51% owned by NexGen Energy from spin-off
 2) also cobalt-nickel project; on August 22, 2022 closing of the acquisition by UEC was completed

Emerging countries (10)

AFRICA (7)

Namibia (4)	A\$
Deep Yellow	1) 618.2
Bannerman Energy	2) 296.2
Elevate Uranium	3) 128.1
	C\$
Forsys Metals	105.4

notes Namibia:

- 1) merger with Vimy Resources effective July 27, 2022, new Deep Yellow trading Aug. 5, 2022
 2) name change from Bannerman Resources effective July 13, 2021
 3) name change from Mareica Energy effective June 8, 2021

Niger (3)	C\$
Global Atomic	1) 618.2
GoviEx Uranium	2) 136.3
ENRG Elements	3) 26.0

Malawi (1)	A\$
Lotus Resources	305.0

notes Niger:

- 1) also 49% interest in zinc project in Turkey
 2) acquired African uranium assets in Zambia, Mali and Namibia from Denison Mines in consideration of 25% of GoviEx' shares; Denison Mines ownw appr. 6% of issued shares
 3) also copper-silver project in Botswana and copper-gold project in Western Australia

SOUTH AMERICA (1)

Argentina(1)	C\$
Blue Sky Uranium	1) 28.0

notes Argentina:

1) uranium-vanadium project

EUROPE (1)

Spain (1)	A\$
Berkeley Energia	151.6

World's top 10 listed uranium exploration/development companies

focused on **traditional countries** (by market valuation)

	Country focus	Trade symbol	Share price Sept. 30 2021	Share price Year-end 2021	Change to Year-end 2021 in %	Market valuation (US\$ million)
NexGen Energy	1) Canada	TSX V NXE	C\$ 5.02	C\$ 5.54	-9	1,757.3
Denison Mines	Canada	TSX DML	C\$ 1.61	C\$ 1.74	-7	962.0
Boss Energy	2) Australia	ASX BOE	A\$ 2.53	A\$ 2.25	12	579.8
Fission Uranium	Canada	TSX FCU	C\$ 0.66	C\$ 0.78	-15	328.4
Iso Energy	Canada	TSX V ISO	C\$ 3.95	C\$ 3.74	6	308.1
enCore Energy *	3) USA	TSX V EU	C\$ 3.57	C\$ 1.60	123	279.9
UEX	4) Canada	TSX UEX	C\$ 0.38	C\$ 0.37	3	153.3
Alligator Energy	Australia	ASX AGE	A\$ 0.05	A\$ 0.06	-17	115.9
Consolidated Uranium	5) USA	TSX V CUR	C\$ 2.01	C\$ 2.87	-30	112.7
Laramide Resources	USA/Australia	TSX LAM	C\$ 0.50	C\$ 0.71	-30	75.2

Total market capitalization

4,672.6

* featured as a **Special Situation** and included in the **2022 Shortlist of investment recommendations**

** price as at July 26, 2022

1) holds 53% in Iso Energy, from spin-off

2) name change from Boss Resources effective November 26, 2020; also nickel-copper project in Sweden and gold project in Senegal

3) entered into a binding agreement effective September 1, 2020 to acquire all of Westwater Resources' United States uranium assets; announced on September 7, 2021 a definitive arrangement agreement whereby the Company will acquire Azarga Uranium

4) on August 22, 2022 closing of the acquisition by UEC was completed

5) announced on July 15, 2021 a definitive asset purchase agreement with Energy Fuels to acquire a portfolio of conventional uranium projects located in Utah and Colorado for consideration of US\$ 8 million over a period of 3 years and 19.9% in outstanding CUR

World's top 10 listed uranium exploration/development companies

focused on **emerging countries** (by market valuation)

	Country focus	Trade symbol	Share price August 31 2022	Share price Year-end 2021	Change to Year-end 2021 in %	Market valuation (US\$ million)
Global Atomic *	1) Niger	TSX V GLO	C\$ 3.48	C\$ 4.19	-17	451.3
Deep Yellow *	2) Namibia	ASX DYL	A\$ 0.85	A\$ 0.86	-1	401.8
Lotus Resources	3) Malawi	ASX LOT	A\$ 0.23	A\$ 0.31	-26	198.2
Bannerman Energy	Namibia	ASX BMN	A\$ 1.98	A\$ 2.65	-25	192.5
Berkeley Emergia	4) Spain	ASX BKJ	A\$ 0.28	A\$ 0.23	22	124.8
GoviEx Uranium *	Niger/other African countries	TSX V GXU	C\$ 0.23	C\$ 0.36	-36	99.5
Aura Energy	5) Mauritania	AIM AEE	GBX 17.00	GBX 13.50	26	92.7
Elevate Uranium	Namibia	ASX EL8	A\$ 0.47	A\$ 0.47	0	83.3
Forsys Metals	Namibia	TSX FSY	C\$ 0.54	C\$ 0.85	-36	76.9
Blue Sky Uranium *	6) Argentina	TSX BSK	C\$ 0.14	C\$ 0.20	-30	20.4

Total market capitalization

1,741.4

* featured as a **Special Situation** and included in the **2022 Shortlist of investment recommendations**

1) also 49% interest in operating zinc project in Turkey

2) acquisition of Vimy Resources valued at US\$ 493 million effective July 27, 2022; completed on August 5, 2022

3) acquired 85% stake in major uranium project in Malawi from Paladin Energy; also cobalt project in NSW Australia

4) On November 19, 2021, the Company announced it has received notification from the Ministry for Ecological Transition and the

6) also world-class vanadium and battery project in Sweden

7) uranium-vanadium project

Overviews of worldwide uranium production and exploration companies by country

September 30, 2022

	Trade symbol		Share price		Change in %	12 months		Market capitalization million	
			Sept. 30 2022	Year-end 2021		H	L		
Canada - Athabasca Basin									
Producer:			C\$	C\$		C\$	C\$	C\$	US\$
Cameco	1)	TSX CCO	36.66	27.58	33	41.05	23.03	14,606.8	10,663.0
Development / Exploration:									
NexGen Energy		TSX NXE	5.02	5.54	-9	8.30	4.43	2,407.2	1,757.3
Denison Mines		TSX DML	1.61	1.74	3	2.64	1.19	1,317.8	962.0
Fission Uranium		TSX FCU	0.66	0.78	-15	1.25	0.56	449.8	328.4
IsoEnergy		TSXV ISO	3.95	3.74	6	6.53	2.51	422.0	308.1
Baselode Energy		TSXV FIND	0.79	0.81	-2	1.54	0.56	68.3	49.8
Skyharbour Resources		TSXV SYH	0.47	0.49	-4	0.84	0.29	67.1	49.0
CanAlaska Uranium *		TSXV CVV	0.52	0.44	18	0.81	0.27	53.0	38.7
Fission 3.0		TSXV FUU	0.09	0.22	-61	0.30	0.07	25.7	18.7
Purepoint Uranium Group		TSXV PTU	0.07	0.09	-18	0.17	0.06	24.1	17.6
Traction Uranium		CSE TRAC	0.36	0.90	-61	1.08	0.28	18.3	13.4
Eagle Plains Resources		TSXV EPL	0.16	0.17	-6	0.19	0.14	17.7	12.9
Azincourt Energy	2)	TSXV AAZ	0.05	0.07	-29	0.26	0.05	11.4	8.3
ALX Resources		TSXV AL	0.04	0.09	-56	0.15	0.03	8.3	6.1
CAT Strategic Metals		CSE CAT	0.02	0.04	-63	0.06	0.01	3.6	2.6
Uravan Minerals		TSXV UVN	0.16	0.26	-38	0.39	0.11	0.8	0.5
			A\$	A\$		A\$	A\$	A\$	US\$
92 Energy		ASX 92E	0.53	0.68 x	-23	0.94	0.35	46.2	30.0

* featured as a **Special Situation** and included in Shortlist of investment recommendations

x share price as of April 14, 2021

1) 40% interest in JV Inkai, Kazatomprom of Kazakhstan owning 60%; resumed production at Cigar Lake in Q2 2021; expects to produce up to 12 million pounds U3O8 on a 100% basis in 2021

2) also lithium joint venture in Canada and letters of intent to acquire lithium-uranium project in Peru and cobalt project in Ontario

Overviews of worldwide uranium B46:N83 production and exploration companies by country

September 30, 2022	Trade symbol		Share price		Change in %	12 months		Market capitalization million	
			Sept. 30 2022	Year-end 2021		H	L		
United States									
Stand-by producers:			US\$	US\$		US\$	US\$	US\$	US\$
Uranium Energy	AMEX	UEC	3.50	3.35	4	6.60	2.34	1,170.0	1,170.0
Energy Fuels	1)	NYSE MKT UUUU	6.12	7.63	-20	11.39	4.69	964.4	964.4
Ur-Energy		NYSE MKT URG	1.53	1.22	25	2.72	1.26	340.9	340.9
Peninsula Energy	2)	NYSE OTC PENMF	0.10	0.14	-29	0.24	0.08	99.9	99.9
Development / Exploration:			C\$	C\$		C\$	C\$	C\$	US\$
enCore Energy *	3)	TSX.V EU	3.57	1.60	123	6.30	2.91	383.4	279.9
Consolidated Uranium	4)	TSX.V CUR	2.01	2.87	-30	3.29	1.51	154.4	112.7
Laramide Resources	5)	TSX LAM	0.50	0.71	-30	1.12	0.39	103.0	75.2
Western Uranium & Vanadium	6)	OTCQX WSTRF	1.17	1.46	-20	3.00	0.80	51.0	37.2
Anfield Energy		TSX.V AEC	0.06	0.10	10	0.17	0.06	37.4	27.3
Virginia Energy	7)	TSX.V VUI	0.35	0.87	-60	0.98	0.26	22.5	16.4
Standard Uranium		TSX.V STND	0.09	0.22	-58	0.48	0.07	13.3	9.7
			A\$	A\$		A\$	A\$	A\$	US\$
Okapi Resources		ASX OKR	0.25	0.35	-29	0.62	0.16	33.3	21.6
ENRG Elements	8)	ASX EEL	0.03	0.02	40	0.05	0.02	151.6	98.5

* featured as a **Special Situation** and included in Shortlist of investment recommendations

1) leading US-based mining company; White Mesa Mill also to produce vanadium and capable to produce REEs

2) also uranium assets in South Africa

3) announced on July 15, 2021 a definitive asset purchase agreement with Energy Fuels to acquire a portfolio of conventional uranium projects located in Utah and Colorado for consideration of US\$ 8 million for a period of 3 years and 19.9% in outstanding CUR common shares;

4) completed the acquisition of uranium assets of Westwater Resources in Texas and New Mexico in enCore shares; transaction closed on January 5, 2021

5) also projects in Australia; uranium ban on major Westmoreland Project in Queensland, Australia

6) uranium - vanadium project

7) On September 30, 2021, the Company received notice that the Virginia Supreme Court had denied the Petition for Appeal on suing the State of Virginia on the uranium ban to access \$ 6 billion deposit

8) name change from Kopore Metals, effective August 3, 2022

Overviews of worldwide uranium production and exploration companies by country

September 30, 2022	Trade symbol		Share price		Change in %	12 months		Market capitalization million	
			Sept. 30 2022	Year-end 2021		H	L		
Australia									
Producer:			A\$	A\$		A\$	A\$	A\$	US\$
Energy Resources of Australia	ASX	ERA	0.21	0.34	-38	0.45	0.16	775.2	503.9
Development / Exploration:									
Boss Energy	ASX	BOE	2.53	2.25	12	3.10	1.61	892.0	579.8
Alligator Energy	ASX	AGE	0.05	0.06	-9	0.12	0.04	178.3	115.9
Havilah Resources	1)	ASX HAV	0.31	0.18	74	0.45	0.16	96.6	62.8
Energy Metals Ltd.		ASX EME	0.16	0.27	-43	0.41	0.11	32.5	21.1
Cauldron Energy	2)	ASX CXU	0.01	0.03	-66	0.04	0.01	7.0	4.5

1) also uranium assets in Argentina

2) also gold project in Victoria State

Overviews of worldwide uranium production and exploration companies by country

September 30, 2022		Trade symbol		Share price		Change in %	12 months		Market capitalization	
				Sept. 30 2022	Year-end 2021		H	L	million	
CENTRAL ASIA										
Kazakhstan										
Producer:				US\$	US\$		US\$	US\$	US\$	US\$
Kazatomprom	1)	LSE	KAP:LI	25.18	36.75	-31	49.55	22.05	6,534.2	6,534.2
AFRICA										
Namibia										
Stand-by producer:				A\$	A\$		A\$	A\$	A\$	US\$
Paladin Energy		ASX	PDN	0.78	0.88	-12	1.04	0.53	2,300.0	1,495.0
Development / Exploration:				A\$	A\$		A\$	A\$	A\$	US\$
Deep Yellow *	2)	ASX	DYL	0.85	0.86	-2	1.26	0.55	618.2	401.8
Bannerman Energy	3)	ASX	BMN	1.98	2.65	-25	4.35	1.50	296.2	192.5
Elevate Uranium	4)	ASX	EL8	0.47	0.47	0	0.83	0.35	128.1	83.3
				C\$	C\$		C\$	C\$	C\$	US\$
Forsys Metals		TSX	FSY	0.54	0.85	-36	1.18	0.39	105.4	76.9
Niger				C\$	C\$		C\$	C\$	C\$	US\$
Global Atomic *	5)	TSX.V	GLO	3.48	4.19	-17	5.10	2.58	618.2	451.3
GoviEx Uranium *	6)	TSX.V	GXU	0.23	0.36	-35	0.52	0.21	136.3	99.5
Malawi				A\$	A\$		A\$	A\$	A\$	US\$
Lotus Resources		ASX	LOT	0.23	0.31	-26	0.46	0.19	305.0	198.2
Mauritania				GBX	GBX		GBX	GBX	GBX	US\$
Aura Energy	7)	AIM	AEE	17.00	13.50	26	19.00	8.50	85.1	92.7

* featured as a **Special Situation** and included in Shortlist of investment recommendations

1) listed on London Stock Exchange) as at November 16, 2018 through an IPO offering of 15% of the Company's outstanding shares at a price of US\$ 11.60

2) merger with Vimy Resources effective July 27, 2022; new Deep Yellow shares trading on August 5, 2022

3) name change from Bannerman Resources effective July 13, 2021

4) name change from Marenica Energy effective June 8, 2021

5) also 49% interest in operating zinc project in Turkey

6) also major uranium assets in Zambia, and assets in Mali and Namibia

7) also world-class vanadium and battery metal project in Sweden

Overviews of worldwide uranium production and exploration companies by country

September 30, 2022	Trade symbol		Share price		Change in %	12 months		Market capitalization million	
			Sept. 30 2022	Year-end 2021		H	L		
LATIN + CENTRAL AMERICA									
Argentina			C\$	C\$		C\$	C\$	C\$	US\$
Blue Sky Uranium *	1)	TSXV BSK	0.14	0.20	-28	0.35	0.12	28.0	20.4
1) uranium-vanadium project									
* featured as a Special Situation and included in <u>Shortlist of investment recommendations</u>									

Overviews of worldwide uranium production and exploration companies by country

September 30, 2022	Trade symbol		Share price		Change in %	12 months		Market capitalization million	
			Sept. 30 2022	Year-end 2021		H	L		
Other countries: EUROPE									
Spain			A\$	A\$		A\$	A\$	A\$	US\$
Berkeley Energia	1)	ASX BKY	0.28	0.23	22	0.64	0.14	151.6	124.8
1) On <u>November 19, 2021</u> , the Company announced it has received notification from the <u>Ministry for Ecological Transition and the Democratic Challenge ("MITCO")</u> that it has rejected the Authorization for construction of its <u>Salamanca</u> deposit									

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January	25 – 27	Mines and Money Online Connect
April	5 – 7	Mines and Money Online Connect
April	6 – 8	Madrid Energy Conference (MEC 2022), Madrid, Spain
April	6 – 8	MINEX Kazakhstan – Nur Sultan, Kazakhstan
May	4 – 5	Mines & Money London (Hybrid)
June	1 – 3	DRC Mining Week – Lubumbashi, DRC
June	13 – 15	PDAC 2022 – Toronto, Canada – in person
June	28 – 29	PDAC 2022 – Toronto, Canada – ONLINE
June	28 – 30	Suriname Energy, Oil & Gas Summit, Paramaribo, Suriname
July	26 – 27	Lithium Latin America – Buenos Aires, Argentina
August 30 – September 1		Mines and Money Online Connect
September	5 – 6	Mining Journal Select - London
September	14 – 16	Guyana Basins Summit – Georgetown, Guyana
November	1 – 3	ZIMEC 2022 – Kitwe, Zambia
November	2 – 4	Int.Mining and Resource Conf. (IMARC) – Melbourne, Australia
November	15 – 17	Symposium Mines Guinee – Conakry, Guinea
November	29	MINEX Eurasia
November 29 – December 1		Resourcing Tomorrow, brought to you by Mines and Money - London

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