



NUCLEAR SECURITY
A FORTNIGHTLY NEWSLETTER ON NUCLEAR DEFENCE, ENERGY AND PROLIFERATION FROM
CENTRE FOR AIR POWER STUDIES

OPINION – Mzukisi Qobo

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Energy Security and Geopolitics: Why Nuclear Power Makes Sense

Russia's invasion of Ukraine has dramatically changed the global energy landscape. Three months after the Glasgow climate conference concluded in November 2021, the conversations about going green suddenly turned to nuclear energy. This shift is not only taking place in Europe, which countenances the threat of throttled energy supplies from Russia. Several Asian countries have also had to reconsider their net-zero pathways. Some European utilities resorted to using coal to keep homes warm and industrial activity steady, underlining how vital energy security is for economic prosperity and social stability. Meanwhile, the nuclear reliant countries such as France have been slightly less affected. This nuclear pivoting by some countries is also a mark of proliferating global risks and uncertainties.

Within a few weeks of Russia's invasion of Ukraine, countries such as Colombia, South Africa, Australia and Indonesia became attractive to traders for their coal as gas prices shot up and supply from Russia looked increasingly uncertain. Of course, Europe's appetite for coal is transient,

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induced mainly by an urge to reduce reliance on Russian coal and gas. But the bigger story is not the redemption of coal from all the climate sins it has committed over a century and a half, nor its restoration as an attractive fuel of the future. Instead, it is about the importance of energy security and that this cannot be provided solely by solar and wind. Currently, solar and wind suffer intermittency — there is no perfect matching of demand and supply; there is also no utility-scale storage system that could

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ensure a steady supply through all seasons. Although attractive as clean energy, wind and solar are not reliable partners for countries that are latecomers to industrialisation and that still need to overcome socioeconomic problems. Against this backdrop, nuclear energy has become a hot topic of the day. The debate on energy is increasingly turning towards energy security as a crucial part of national security.

Recently, the minerals and energy minister, Gwede Mantashe, mentioned that his department intends to call for proposals to build new nuclear capacity. He is likely to encounter resistance, with some brandishing the corruption card while others advance safety and cost rationales. Regarding corruption, this should not prevent policy from planning for the long-term. It is myopic to oppose large-scale infrastructure programmes or development plans because they might be corrupted instead of formulating strategies to combat corruption. We need strong governance norms, tighter procurement and greater oversight by independent institutions. On the cost side, now that regions such as the European Union are reclassifying nuclear as green energy, and there seems to be growing acceptance of nuclear as a carbon-free source that can help countries leapfrog their energy transition and offer baseload, it is possible that the cost of financing could come down. Technological breakthroughs aimed at bringing down costs, responding to safety concerns, and meeting the sustainability test are spearheaded by new tech companies that enjoy significant financial backing from impact funders and venture capital.

The EU Taxonomy, which now reclassifies nuclear

as green, has signalling power: if technology is classified as meeting clean energy criteria, it could potentially attract a lower cost of finance from financiers that are looking at meeting environmental, sustainability, and governance (ESG) requirements. Institutional investors, including pension funds and sovereign wealth funds, have been chasing ESG criteria recently, with the low cost of capital dangled as a carrot. Energy security and national security considerations drive much of the policy shift around the world. The majority of EU countries, except for Germany, Austria, Denmark, Luxembourg and Spain, are in support of the inclusion of nuclear as a form of green energy in the EU Taxonomy.

Germany is caught between a rock and a hard place because it finds itself having to decelerate its exit from coal to calibrate down its gas dependence on Russia. Belgium has made an about-turn on its earlier decision to shut down two reactors and now swears by nuclear power as the future. This is more so for those countries in Russia's backyard — Poland, Romania and the Czech Republic. The EU has always prided itself as a global norm-setter — what is good for Europe is also good for others.

The reclassification of nuclear as green energy raises interesting questions about whether the EU will direct some of its finance for clean energy to nuclear build programmes in developing countries. If nuclear energy is reclassified as green energy, surely the slice of the yet to be delivered \$100-billion a year climate finance should go towards nuclear energy? This is also a question that financial services companies and institutional investors will have to ponder, especially given the

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likely ESG benefits of nuclear energy. Outside of Europe, other countries are exploring nuclear energy as a green investment of the future. In South Korea, the incoming leadership of Yoon Suk-yeol has decided to pause the previous administration's programme of phasing out nuclear energy and will instead allow more operators of nuclear power stations to extend their service contracts well beyond their expiry dates.

Singapore is also exploring nuclear options as a key part of its decarbonisation. The government's high-powered task team commissioned by the Energy Market Authority is looking at an energy mix where nuclear will make up 10%, with hydrogen comprising the bulk of energy production. The nuclear movement has serious backers. Investors such as Bill Gates also took a bet on nuclear energy through his company Terra Power. Gates characterises nuclear as "the only carbon-free energy source that can reliably deliver power day and night, through every season, almost, anywhere on Earth, [and] that has been proven to work on a large scale."

There is a new wave of venture-backed tech start-ups emerging as part of the growing efforts to advance a new generation of safer reactors, Generation IV that, according to the Silicon Valley investor John Doerr, could deliver safety, sustainability, efficiency and lower cost.

The Garzweiler opencast coal mine in Juechen, Germany. Germany does not support nuclear power but has had to slow down its exit from coal because of the war in Ukraine and the country is dependent on gas from Russia. For many developing countries that are still lagging behind industrial development, nuclear power might provide a clean energy pathway.

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In the African continent, countries such as Kenya are ramping up efforts to build commercial nuclear reactors near Kilifi, north of Mombasa, and with a long-term goal in mind — to commission the first reactor by 2036. Resource dependent African countries may need to turn to nuclear to achieve their industrial development plans since the window is gradually closing on fossil fuel-based energy sources. Countries such as Angola have recently unveiled ambitious plans for ports rehabilitation, the building of large-scale infrastructure and diversification from oil dependence to developing new industrial sectors — all of which cannot be achieved by relying solely on solar and wind, as necessary as these technologies are for mitigating climate-related risks. South Africa is not condemned to anaemic growth; if it is truly ambitious, it will need to plan for long-term energy security where nuclear is an integral part of the energy mix and thus powers its industrial development.

This is even more important given that South Africa does not have the security of supply for gas as a transitional fuel that offers baseload. When you don't have energy security, the quality of your economic sovereignty is, as we have learnt with many European countries, at the mercy of other countries that may be hostile in the future.

Source: <https://mg.co.za/opinion/2022-04-30-opinion-energy-security-and-geopolitics-why-nuclear-power-makes-sense/>, 30 April 2022.

OPINION – Alexander Nazaryan

How Serious is Russia about Nuclear War?

Mainstream thinking about nuclear war has been guided by two related realities: that atomic

weapons are immensely destructive and that if used once, they will be used repeatedly in a series of back-and-forth strikes that will only compound the devastation until there is nothing much left to devastate. Those were the lessons of Proud Prophet, an intensive 1983 simulation conducted by the US government at the National Defense University in which dozens of security agencies and military commands took part. Proud Prophet began with what was expected to be a limited nuclear strike by the Soviet Union, only to quickly slip from the grasp of the combatants. ...

Given the diligence with which the simulation was conducted, Proud Prophet offered chilling evidence that however a nuclear war began, it could end only in annihilation. Fears of such an outcome receded after the dissolution of the Soviet Union, especially as nonstate actors like al-Qaida preoccupied the U.S. national security establishment. Still, it was only a matter of time before new geopolitical tensions gave rise to fresh nuclear anxieties. Russia's invasion of Ukraine in February did just that.

"The risk is higher now than it has been in decades," Geoff Wilson, a policy analyst at the Center for Arms Control and Non-Proliferation, told... Russia has openly courted the possibility, with Russian television on 01 May, 2022, showing what a nuclear strike might do to the United Kingdom, one of many NATO allies now helping Ukraine. On 04 May, 2022, Russia conducted tests with nuclear-capable Iskander missile systems in Kaliningrad, a Russian territory within striking distance of European capitals and military installations.

There followed assurances from the Russian foreign ministry that Russia was not contemplating nuclear war. After weeks of bluster, the assurance was difficult to parse. "We're dealing with a nuclear-armed state," Air Force Secretary Frank Kendall told the Washington Post late April, 2022. "You cannot ignore that as you

make decisions about how to respond." However, some military analysts believe that harping on Russia's nuclear capability is a mistake, one that emphasizes history over present-day reality. They argue that even if Russian President Vladimir Putin were to order a nuclear strike, it would be with smaller, tactical nuclear weapons, not the much bigger strategic devices that could obliterate cities like London or New York. And they argue that even if Putin did use nuclear weapons, the West could

The tragic irony of the current moment is that Russia has levelled Ukrainian cities and killed thousands of Ukrainian citizens without having to resort to nuclear weapons. Although the West has been consistently supplying Ukraine with materiel, fears of provoking Russia into a nuclear attack have kept the United States and European allies from direct involvement in the conflict.

answer with conventional airstrikes as devastating as a nuclear attack but without the prospect of that counterstrike escalating into the kind of tit for tat envisioned by Proud Prophet. "We have been so worried about nuclear weapons and World War III that we have allowed ourselves to be fully

deterred," retired Gen. Philip Breedlove, the former NATO supreme allied commander, said to Radio Free Europe in early April.

The tragic irony of the current moment is that Russia has levelled Ukrainian cities and killed thousands of Ukrainian citizens without having to resort to nuclear weapons. Although the West has been consistently supplying Ukraine with materiel, fears of provoking Russia into a nuclear attack have kept the United States and European allies from direct involvement in the conflict. In response to the same dynamic that frustrated Breedlove, retired U.S. Army Col. Sam Gardiner, who was a war games expert at the Naval War College and is a leading authority on military simulation, compiled a PowerPoint presentation last month in which he argued that if Russia did go nuclear, it would be with a smaller, 1-kiloton tactical device as opposed to the 15-kiloton device the United States dropped on Hiroshima in 1945.

Russia has recalibrated its own thinking on nuclear deterrence since the collapse of the Soviet Union, as it has watched NATO creep ever closer to its borders. After NATO intervened to stop the war in Kosovo in 1999, the Kremlin held an exercise

called Zapad ("West") that simulated another NATO attack, this one on Russia. A poorly trained Russian military failed to stop a NATO attack, leading to a nuclear strike against Europe. This strike would be with smaller, tactical weapons in order to avoid the kind of annihilation Proud Prophet envisioned. Subsequent war games helped the Kremlin hone a strategy known as "escalate to de-escalate," in which nuclear weapons frighten the enemy into submission without leading to mutually assured destruction.

Effectively, "escalate to de-escalate" lowered the threshold for when nuclear weapons would be used but also called for less powerful nuclear weapons. The new approach informed Russia's increasingly aggressive approach to former Soviet republics under Putin, including during his first incursion into Ukraine eight years ago.

"Russia's policy probably limited the West's options for responding to the 2008 war in Georgia," deterrence expert Nikolai Sokov wrote for the *Bulletin of the Atomic Scientists* in 2014. "And it is probably in the back of Western leaders' minds today, dictating restraint as they formulate their responses to events in Ukraine." For some in the U.S. military, the current invasion of Ukraine demands a fresh outlook, one that does not shy away from recognizing that Putin could use nuclear weapons. Some also wonder if other adversaries see Western deference to Russia's nuclear might as a good reason to start making nuclear threats of their own.

At a congressional hearing on 05 May 2022, Adm. Charles Richard, who heads U.S. Strategic Command, warned that China is "watching the war in Ukraine closely and will likely use nuclear coercion to their advantage in the future. Their intent is to achieve the military capability to reunify Taiwan by 2027, if not sooner." Gardiner believes the Kremlin's "escalate to de-escalate" policy commits Russia to using only tactical nuclear weapons in Ukraine, where the battle has

taken on shades of the Zapad exercise. Gardiner does not believe Russia would use strategic nuclear weapons, even if the military situation continued to deteriorate. "You can only go so big, otherwise you will have crossed the line."

Putin is likely aware that using a nuclear weapon of any size in an offensive war would further alienate Russia from the West. "One nuclear weapon is still a nuclear weapon," said Wilson, the non-proliferation expert. "That's a taboo." It may also be pointless. Ukrainian forces are too dispersed for such a strike to swing the war decisively in Russia's favour. "Russian tactical nuclear weapons would have little or no impact on the operational battle," Gardiner argues in his presentation, which he has shared with top military officials in Europe and the US (including Breedlove, the former NATO commander).

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And even though Russia's offensive has proved ineffective so far, its indiscriminate shelling and bombing have levelled

Ukrainian cities like Mariupol and Kharkiv. "Damages from the Russian use of tactical nuclear weapons are no more horrific than the current damages being experienced in Ukraine from conventional weapons," Gardiner wrote. Nor does Gardiner believe that a nuclear attack by Russia would require a nuclear response by the West. "Even if the Russians were to do something stupid, there is no need for us to follow that. We could destroy the majority of Russian forces in Ukraine with a five-day air campaign," he told Yahoo News.

Another presentation he produced and shared with current Air Force officials shows that such a retaliatory assault would cripple the Russian military in the European sector while leading to the loss of only 10 U.S. aircraft. "Most war games have shown that once you start any nuclear exchange, things escalate very quickly," said military historian Phillips O'Brien of St. Andrews University in the United Kingdom, who

favourably shared Gardiner's presentation on Twitter. He said he was intrigued by the presentation because "it opened up the possibility of responding to a Russian tactical nuclear usage through a very strong/devastating conventional response as opposed to possibly nuclear escalation." For some experts in nuclear proliferation, entertaining nuclear exchanges is fundamentally dangerous. "If Putin uses [a tactical nuclear weapon]," North-eastern University political scientist Mai'a Cross told Yahoo News in an email, "he is demonstrating to the West that he will not back down until he achieves his goals. His willingness to break the taboo would likely alarm Western powers and put them on heightened alert as well, which only increases the chances of accidentally setting off a larger war."

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Such a scenario would be an echo of Proud Prophet, in which a series of aggressions and counter-aggressions, manoeuvres and misunderstandings, deepened the crisis. "These are world-ending arsenals we are talking about," Wilson said. "Everyone should be afraid of them."

Source: <https://news.yahoo.com/how-serious-is-russia-about-nuclear-war-090015298.html>, 07 May 2022.

OPINION – Jon Jackson

Nuclear War Threat Drives Greater Divide between US, China

The already tenuous relationship between the US and China risks further deterioration following recent comments from each country regarding the threat of nuclear war the other presents. Admiral Charles Richard spoke on 05 May, during a hearing

assembled by the Senate Armed Services strategic forces subcommittee about the escalated nuclear threat posed by China since its ally Russia began its invasion of Ukraine. "We are facing a crisis deterrence dynamic right now that we have only seen a few times in our nation's history," Richard, who is head of the U.S. Strategic Command, said. "The war in Ukraine and China's nuclear trajectory—their strategic breakout—demonstrates that we have a deterrence and assurance gap based on the threat of limited nuclear employment."

"China follows a self-defensive nuclear strategy and keeps its nuclear forces at the minimum level required to safeguard national security. We stay committed to no first use of nuclear weapons at any time and under any circumstances, and undertake unequivocally and unconditionally not to use or threaten to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones," Zhao said. "This policy remains clear and consistent. China opposes any form of 'China nuclear threat' theory." He further charged that U.S. officials were trying to shift "the blame to others." "Some individuals in the U.S. have been hyping up various versions of the so-called 'China nuclear threat,'" Zhao said. "As is known to all, the U.S. is the biggest source of nuclear threat in the world."

We are facing a crisis deterrence dynamic right now that we have only seen a few times in our nation's history," Richard, who is head of the U.S. Strategic Command, said. "The war in Ukraine and China's nuclear trajectory—their strategic breakout—demonstrates that we have a deterrence and assurance gap based on the threat of limited nuclear employment.

"The U.S. should earnestly assume its special and primary responsibilities toward nuclear disarmament, continue to further substantively reduce its nuclear arsenal in a verifiable, irreversible and legally-binding manner," he added. "The U.S. should take the same nuclear policy with China to make due contribution to

reducing nuclear threats and promoting nuclear disarmament.”

During his comments at 05 May’s hearing, Admiral Richard said China was monitoring the war in Ukraine “closely and will likely use nuclear coercion to their advantage in the future. Their intent is to achieve the military capability to reunify Taiwan by 2027 if not sooner.”

The U.S. Defense Department previously said in November that China had been working on building up its nuclear arsenal, and a department report stated China could have more than 1,000 nuclear warheads by 2030, the Associated Press reported. A senior Chinese official denied that report in January. “On the assertions made by U.S. officials that China is expanding dramatically its nuclear capabilities, first, let me say that this is untrue,” Fu Cong, director general of the Foreign Ministry’s arms control department, said during a briefing in Beijing at the time, according to the AP. Fu also asserted China would not join nuclear arms reduction talks between the U.S. and Russia unless those countries reduced their arsenals first, since they have the largest nuclear arsenals in the world.

Source: <https://www.newsweek.com/nuclear-war-threat-drives-greater-divide-between-us-china-1704340>, 06 May 2022.

OPINION – Mustafa Caner

Why Is It So Hard to Reach a New Nuclear Deal with Iran?

Even if a deal is reached, there is no guarantee that Iran’s Revolutionary Guards’ military operations will decrease in the Middle East. Even though the election of Joe Biden as U.S. President was interpreted as closing the bracket opened by the Trump era in terms of U.S.-Iranian relations, it is not easy to restore ties once they have deteriorated. After Biden took office in January

2021, the nuclear negotiation process with Iran did not start immediately and has been disrupted many times since then. Nevertheless, the parties did not neglect to signal that they did not avoid negotiations. However, both sides acted much more cautiously following the developments in the Trump era, which resulted in the U.S. withdrawal from the 2015 agreement.

One of the first acts of the Biden government was to remove the Houthis from the list of Foreign Terrorist Organizations (FTOs). On February 12, 2021, U.S. Secretary of State Anthony Blinken announced that Houthis, one of the proxy groups of Iran operating in Yemen, would no longer

Although the US joined the nuclear negotiations in April 2021, the negotiations stalled in May. The Iranian presidential elections, which took place in June, pushed the U.S. into a waiting position. Washington did not want to waste energy and resources for nothing. The new Tehran administration’s approach to nuclear negotiations was still unclear.

be listed as “specially designated global terrorists” (SDGTs) as of February 16. The Houthi movement, a.k.a. Ansar Allah, was designated as a terrorist organization in the last days of the Trump administration. The Biden administration was aiming for two possible implications by delisting Houthis: First, sending

humanitarian aid to Yemen. Second, it would give Tehran a clear message that the new U.S. government was ready to negotiate and reach a new nuclear deal.

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After Ebrahim Raisi was elected president in Iran in June, he had to wait until August to take over the post. Meanwhile, Washington was trying to gauge and predict the new Iranian government’s approach to the nuclear issue. The Raisi government’s initial remarks indicated that even though they were not against nuclear talks, they would negotiate from a harsher position than their

predecessors. After a long delay, the nuclear negotiations were started again in November, and Iran did not negotiate directly with the US. That's why the process was renamed nuclear talks between "Iran and P4+1 countries." The European Union, Russia, and China have been trying to mediate between Tehran and Washington.

However, both Iran and the U.S. do not exclude the option of direct talks in the future. Iranian Foreign Minister Hossein Amir-Abdollahian has said, "If we reach a point in the negotiation process where a good agreement requires a dialogue with the United States, we will not ignore it." For some time, the parties to the nuclear talks worked diligently to reach a solution. Although significant progress has been made in the negotiations, the outbreak of the Russia-Ukraine war has affected nuclear negotiations and changed many balances across the world. The emergence of Iran as an alternative energy source to Russia did not reveal an acceptable picture for the Moscow administration, which has been subjected to the heaviest sanctions in history.

Russia wanted written assurances from Washington that sanctions against it would not obstruct its economic relations with Iran. This demand stopped negotiations once again. After about ten days, Russian Foreign Minister Sergei Lavrov declared that they had "written guarantees" from Washington. After the Russia problem was solved, there was still another big problem to overcome. The Iranian side is insisting that the Iranian Revolutionary Guards Corps (IRGC) should be removed from the U.S. FTOs list. Amir-Abdollahian said that without delisting the IRGC, there would be no deal. According to him, the IRGC issue is Iran's "red line." Even if some political decisions were taken by previous U.S. governments, their effects were so profound that it was not possible to easily reverse them.

Therefore, in some areas, it is necessary to proceed on the route drawn by the previous politicians. The inclusion of the IRGC, one of Iran's official armies, on the list of FTOs by the U.S. is one of these decisions.

The decision to list the IRGC as a terrorist organization, taken by the Trump administration in April 2019 as part of its "maximum pressure" policy, had a symbolic meaning rather than a functional one. However, overcoming the symbolic walls is perhaps more difficult than solving the concrete problems between the two countries. Iran sees its

nuclear program, the IRGC, defense capabilities, and missile technologies as matters of "national pride" above anything else. Whether it is Republican or Democrat, the U.S. administration always problematizes the existence of the Islamic political structure in Iran in terms of legitimacy.

After the U.S. IRGC terrorist listing decision, there was no active conflict between the U.S. army and the Iranian Revolutionary Guards Army.

In Iran, the IRGC is part of a complex web of ties that extends from politics to the economy. It is a complex structure with numerous commercial firms, factories, financial institutions, and companies. This structure interferes with actual politics from time to time, and makes restrictive interventions against elected presidents or political representatives. The role of the IRGC in the determination of Iran's foreign policy, and especially its regional activities, is also very important.

Moreover, before it was declared a terrorist organization, there were many sanctions against the Revolutionary Guards. The Biden government's special envoy to Iran, Robert Malley, has declared that even if the nuclear deal is reached, the sanctions on the IRGC will not be lifted. Furthermore, the latest IRGC attack on Arbil and the Houthi attacks on Saudi Arabia and the UAE only complicate the situation. Therefore, the nuclear agreement will not solve the IRGC problem, but removing the IRGC from the list of FTOs seems inevitable for an effective nuclear deal.

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Hence, even if a new nuclear agreement is signed and the sanctions on Iran are lifted, it is highly unlikely that foreign investors who want to do business with Iran will somehow not touch the IRGC network and will not be the target of sanctions as long as the IRGC remains on the list of FTOs. Moreover, the fact that Iran's official army is on the U.S. terrorist list weakens the possibility of Iran's integration into the world economy as a legitimate actor. Apart from all these factors, some outside actors also oppose the removal of the IRGC from the list of terrorist organizations. At the forefront of these actors are Israel and the UAE. Israel has taken a very harsh stance on the IRGC listing issue as well as opposing a nuclear agreement with Iran. Israeli Prime Minister Naftali Bennett and Minister of Foreign Affairs Yair Lapid said in their joint statement, "The attempt to delist the IRGC as a terrorist organization is an insult to the victims and would ignore documented reality supported by unequivocal evidence."

The UAE has already been a target by Houthis, which the IRGC coordinates. Although there is no official statement from Abu Dhabi, some Israeli sources claim that they are not happy with the possible delisting. Even in Iran, controversial actors heavily criticize the IRGC and oppose the possibility of delisting it from the FTOs list. Faezeh Hashemi Rafsanjani, a former MP and daughter of late Hashemi Rafsanjani, expressed her position on the issue by saying that in order to cut the IRGC from the non-military realm, it is essential to keep them on the sanction list.

Considering all these obstacles, it becomes clear why the Iran nuclear negotiations have been complex, and no result has been reached yet. Even if all challenges are overcome, it is very difficult for the agreement to be permanent under the changing political-military conditions. The fact that congressional elections are on the horizon in the

U.S. and the Republicans are in an advantageous position is another factor that complicates the negotiation process. If a deal is reached, there is no guarantee that the Revolutionary Guards' military operations in the region will decrease. Indeed, Iran's increased nuclear activities, uranium enrichment, and its stockpile will escalate tensions.

Source: <https://politicstoday.org/why-is-it-so-hard-to-reach-a-new-nuclear-deal-with-iran/>, 09 May 2022.

OPINION – Arthur I. Cyr

Nuclear War Danger, Russia and Ukraine

Nuclear arms represented the highest-stakes arena of the Cold War. In response, governments achieved both nuclear and conventional weapons control agreements, and such efforts have continued since that global conflict ended. The Trump administration proved erratic on nuclear weapons matters.

"In any case, the Americans would not respond disproportionately." Peggy Noonan, respected and influential columnist for *The Wall Street Journal*, made that statement regarding the possibility that Russia will use nuclear weapons in the continuing war with Ukraine. Her startling

statement has ambiguity, but implies that the US would launch nuclear weapons only to the extent that Russia did so. That alone is a terrifying prospect, but one which must be considered given alarming public statements by President Putin.

Putin, who prefers to view NATO as the aggressor in the Ukraine war, has stated further escalation of the fighting could introduce nuclear weapons. These distinctively destructive and horrific weapons mercifully have been off limits since the U.S. dropped two of the new devices on Japan cities to end World War II.

Contrary good news, generally ignored by the mass media, is that in January, Moscow and Washington quietly agreed to extend the New START treaty for five years, until 2026. This treaty, signed in 2010 by President Barack Obama and Russia President Dmitry Medvedev, limits nuclear warheads on each side to 1550, plus limitations on missiles and bombers. Nuclear arms represented the highest-stakes arena of the Cold War. In response, governments achieved both nuclear and conventional weapons control

agreements, and such efforts have continued since that global conflict ended. The Trump administration proved erratic on nuclear weapons matters. Initial emphasis on ending North Korea's nuclear weapons program was unsuccessful. In August 2019, the administration withdrew from the INF Treaty, complaining of violations by Russia.

Nuclear Summits involving large numbers of nations and international organizations was an important initiative of the Obama administration. The 2016 Nuclear Summit in Washington D.C. concluded with a formal statement underscoring nuclear weapons control. Unfortunately, Russia did not participate. That reflected Russia's strained relations with other nations following annexation of Crimea in 2014. Nonetheless, the major conference reinforced the important, tangible UN framework to coordinate efforts regarding the threat of nuclear terrorism. Specifically, UN Security Council Resolution 1540, passed in 2004, and the ICSANT, provide a legal foundation for action and facilitate cooperation. The first Nuclear Summit took place in 2010, also in Washington D.C. Others took place in 2012 in Seoul, South Korea, and 2014 in The Hague in the Netherlands.

In 1986, during the Soviet-U.S. summit in Iceland, Soviet General Secretary Mikhail Gorbachev and President Ronald Reagan surprised staffs and the world by pledging to the abolition of all nuclear weapons. That utopian vision fostered a more practical result, the INF Treaty signed by Gorbachev and Reagan in 1987. Reductions are desirable, but efforts to outlaw all nuclear weapons are fundamentally flawed. Destroying all known nuclear weapons would provide a decisive advantage to any power that secretly retained even a few.

Another benchmark in arms control occurred in 1972 when the SALT led to treaties between the U.S. and the Soviet Union limiting both offensive and defensive missile systems. The IAEA, an initiative of President Dwight Eisenhower, facilitates peaceful nuclear energy and provides long-term restraint on nuclear weapons proliferation. Ike, always comprehensive in vision,

also achieved demilitarization of Antarctica. In 1954, Eisenhower firmly vetoed use of nuclear weapons to support France, losing a colonial war in Indochina. In direct terms, he reinforced President Harry Truman's refusal to use nuclear weapons during the Korean War.

Source: <https://www.mcdonoughvoice.com/story/opinion/columns/2022/05/09/nuclear-weapons-use-possible-russia-ukraine-conflict/9703408002/>, 09 May 2022

OPINION – Walter Pincus

U.S. Strategy for Addressing the Nuclear Deterrence and Assurance Gap

The Biden Administration's fiscal 2023 budget and yet-to-be-publicly-released 2022 Nuclear Posture Review (NPR) call for ending research on a low-yield, nuclear SLCM that was begun under the Trump administration. However, on 04 May, 2022, meeting of the Senate Armed Services Subcommittee on Strategic Forces, Adm. Charles Richard, head of STRATCOM, forcefully promoted the need for such a weapon, with no Senator questioning Richard's reasoning. They should have.

The discussion began with Subcommittee Chairman Sen. Angus King (I-Maine) pointing out the SLCM defunding and asking, "Do we have a deterrent capability below the level of a massive response, and if not, isn't that a gap in our current deterrent capacity?" Richard responded saying, "We do have a deterrence capability." He then further explained that in the case of SLCM, it was "a class of deterrence challenge," which he described as "how do you deter limited employment?" By that he meant, in the face of the threatened use of one or more low-yield, tactical or battlefield nuclear weapons, does the U.S. only have high-yield strategic weapons as a response.

Russian President Putin has been threatening such usage of tactical weapons for years, and more often since the beginning of the Ukraine crisis. Adm. Richard, as he has done in previous hearings, said STRATCOM has been working on responses to the limited employment of low-yield

nuclear weapons since 2015, but neither King nor any other Senator asked at that moment what STRATCOM's answer was. Instead, Richard went on to say, "I think it is incumbent on us to learn lessons as we go along, as the threat changes – both China's strategic [nuclear] breakout and what we're learning in real time in the crisis inside Ukraine.... The question becomes, as we go forward, what changes to building capacity and posture do we need to have to better deter the threats we face? I do submit that is the question we should be looking at based on what we are learning from the Ukraine crisis." He added, "The deterrence and assurance gap, it's important not to leave that out."

At that moment, Richard answered his own question by providing his description of the nuclear weapon that apparently would fill his deterrence and assurance gap. He described, "A non-ballistic, low-yield, non-treaty-accountable system that is available without visible generation would be very valuable." It should be no surprise that "non-ballistic" would fit the SLCM cruise missile; as would "non-treaty-accountable" as well as "without visible generation," which is an advantage of a sub-launched missile. When Sen. King asked, "And we don't have that today?" and Adm. Richard responded, "That's correct." The STRATCOM Commander was not quite being honest.

Two years ago, the Trump administration developed a low-yield warhead, the W-76-2, for the D-5 strategic sub-launched missile, which it then deployed in 2019 on Trident submarines. Some of those low-yield W-76-2 warheads are on U.S. Navy submarines on operational patrols today. More important, the W-76-2s were justified three years ago as being a response to the very same threat

of Russian limited employment of battlefield nuclear weapons that Richard used to justify the SLCM. Employing Richard's description, these U.S. nuclear warheads currently in service, are "low-yield" and "without visible generation." True they are on ballistic missiles and treaty-accountable, but so what? Don't the W-76-2s fill Richard's deterrence/assurance gap? He didn't mention them during the meeting on 04 May.

It also needs to be pointed out that there are other low-yield nuclear warheads in the U.S. arsenal that are available to match anything being threatened by Putin. The Air Force has B-61 tactical nuclear bombs – with more than 100 deployed on NATO air bases in Europe – with dial-a-yield capability lower than one kiloton. In addition, the Air Force has hundreds of air-launched cruise missiles, with a more modern one on the way. All can be dialed to low yields. However, when talking about nuclear weapons, U.S. delivery aircraft, such as F-15s, F-22s and B-52s, are often discounted with the argument that they could not penetrate Russian or other enemy anti-air defenses. However, when justifying building new generation fighter aircraft or bombers, the argument always has been that they can penetrate, thanks to their stealth or other electronic defensive capabilities.

Late in the hearing, Sen. Mike Rounds (R-S.D.) asked the basic question: "Can you imagine a world today where the United States did not have a clearly recognized nuclear deterrent capability that helps to keep peace in the world?" Richard explained his version of the theory of nuclear deterrence: "No other capability today, or combination of capabilities, gets anywhere close to the destructive potential of nuclear...When you're in competition with another nuclear capable

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opponent, if you can't deter their vertical escalation, everything else is useless to you. But the reverse is also true. If you set that strong [nuclear] foundation, then using every military and other instrument of national power is actually much to your benefit because it enables you to resolve conflict at the lowest possible level of violence."

Rounds then asked, "What do you mean when you say the deterrent [involves]...that you have multiple options available for the President of the United States in order to keep peace?"

Richard responded: "What you want to do is to be able to offer the President any number of ways at which he might be able to create an effect that will change the opponent's decision calculus and get them to refrain or otherwise seek negotiations, vice continued hostilities. So, ballistic versus non-ballistic. Do you want it visible or do you want it not visible; do you want it prompt or do you want it [to] come in a long period of time. Each of these is very situational specific." Richard then went on to link those views to the SLCM program.

He said, "My recommendation on the SLCM, for example, is not an effort to re-litigate the Nuclear Posture Review [which ends the SLCM program]. It is based on the conditions we find ourselves in today. When I look at what I am able to offer the President, and ask myself what would do a better job, lower the risk, give us more confidence in our deterrent capability, that's where that recommendation is a specific example of the broader – that's why you want a lot of options."

One problem for Richard is that the term "options" for the President when discussing nuclear weapons has two different contexts. In one case it involves public acknowledgement for the purpose of deterrence Russia or perhaps China or North Korea. Another purpose could be to encourage Congress to fund one weapon or another. But in the second case of "options," which

would not be public, Richard would be involved in giving the President his alternatives when discussing the ordering of the possible use of nuclear weapons against an enemy. That would be a totally different type of conversation. In the case of SLCM, for example, is Richard publicly promoting the weapon for deterrence value, to show Putin that the U.S. has yet another alternative to respond to his threatened use of battlefield nuclear weapons – even though the W-76-2 is already deployed? Or does Richard believe the SLCM has some needed military value

that the W-76-2 and other low-yield nuclear weapons don't have?

During 04 May, hearing, Richard said the Biden 2022 NPR "has produced in my opinion, a very good strategy. I think as we implement the NPR, we have to take that strategy, and then as threats change...We don't know where China is going to wind up in capability and capacity. We're learning

probabilities are different, based on what we are seeing in Ukraine, and the NPR calls for that. The next step is to actually implement that process and ask ourselves what posture, what capability, what capacity do we need to execute that good strategy?" Against the background that Richard has created, don't be surprised if the Democratic-led Congress reinstates fiscal 2023 funding for the SLCM and even adds funds to step up development of the new W-93 new strategic warhead to meet the Chinese rapid nuclear build-up.

Source: <https://www.thecipherbrief.com/column/fine-print/u-s-strategy-for-addressing-the-nuclear-deterrence-and-assurance-gap>, 10 May 2022

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OPINION – Jonathan Cripps

What does the British Energy Security Strategy Mean for New Nuclear?

Nuclear power is currently an important part of the UK energy mix, representing around 16% of our electricity generation. However, around half of the UK's existing nuclear power stations are

due to be decommissioned by 2025. As the UK grapples with how to disentangle itself from dependence on Russian gas, the question of how this gap will be filled is becoming increasingly pressing.

Against this backdrop, on 7 April Government announced the British Energy Security Strategy (the “**Strategy**”) and the development of a Future System Operator (“**FSO**”) has also been announced. The Strategy deals with how the development of oil and gas, renewables, nuclear and hydrogen will increase energy security in the UK while focusing on green targets. The FSO will ensure that the energy system is operated in such a way that pressure on the system is managed. In particular, the renewed focus on nuclear power is an interesting development as it has the potential to address issues of energy security as well as wider economic concerns. This is particularly so given that nuclear power is a route to decarbonisation, energy security and job creation.

Indeed, it is very difficult to see how the UK could achieve net zero without nuclear being a critical part of the mix. Building up to 15 GW by 2035 would save 31 million tonnes of carbon emissions per year compared to gas generation. As well as this, nuclear power has the potential to fuel the UK jobs market, with Sizewell C estimating that the project would support 70,000 jobs across the UK over construction, as well as jobs in long-term operation and supply chain. In the same vein, Rolls Royce estimates the **SMR** programme would generate about 6,000 jobs in the next five years, and 40,000 over the next 15, which will involve long-term jobs in manufacturing as well as operation. These jobs would be spread across the UK, with a large proportion of manufacturing taking place outside of London and the South East. Here, we consider what the announcement of the Strategy and the FSO means for nuclear and energy security, and

whether it goes far enough to ensure that nuclear power is a commercial proposition for future investors.

Role of Nuclear in the Strategy: The paper outlines a number of ways in which the development of new nuclear will be encouraged in the coming years. In particular, the aim is for nuclear to represent up to 25% of the UK’s projected energy needs in 2050 (corresponding to up to 24GW of generation capacity). This ambitious target is to be achieved through the following initiatives:

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- Two new nuclear projects (including SMRs) will be brought to final investment decision in the next Parliament, building on the previous ambition of one in this Parliament.

- There is also a more general ambition to improve Government’s “track record” by delivering the equivalent of one nuclear reactor per year.

- The Strategy also reiterates the Government’s £2 billion investment in nuclear which was announced in the Prime Minister’s Ten Point Plan, including £100 million to support the development of Sizewell C, and £210 million to bring through SMRs.

In order to deliver this, the Strategy outlines the following schemes:

- As announced in the Comprehensive Spending Review, the £120 million Future Nuclear Enabling Fund will be launched, which is designed to remove barriers to entry to enable the financing and construction of new nuclear projects. Further details on how this fund will be operated are due to be published this year, along with a roadmap for deployment.

- A new body will be set up to oversee the development and construction of new projects known as the ‘Great British Nuclear’ vehicle. The Strategy states that the Government will “work with industry” to determine the precise scope of

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this body, but its role may include the selection of sites, oversight and assistance with the planning process and bringing private companies together to run the sites.

· In 2011, a number of National Policy Statements (“NPSs”) were designated to deal with nationally important infrastructure. One such NPS dealt with nuclear, and has designated eight sites which are considered suitable for nuclear power. The Strategy states that there will be an “overall siting strategy for the long-term”, pointing to the potential for these existing sites to be reconsidered or for further sites to be included in the list.

· The Strategy states that Government will work with regulators to identify any duplication or streamlining potential in the consenting and licensing process of new nuclear power stations, without compromising on their safety, including on the “harmonisation of international regulation”.

· Finally, there is an ambition to collaborate with other countries to accelerate work on advanced nuclear technologies, including both SMRs and Advanced Modular Reactors.

Future System Operator: In addition to the Strategy, the Government, alongside Ofgem, has also announced the creation of a new FSO to oversee the UK’s energy system and manage system pressures brought about by decarbonisation. The FSO will require primary legislation and once this has been passed, it will serve to review the UK’s energy system and integrate existing networks with emerging technologies, such as low-carbon hydrogen, carbon capture and storage, and offshore wind networks. The FSO will be a public corporation but with operational independence from Government, and will be founded on the existing capabilities of the Electricity System Operator

(“ESO”), and, where appropriate, National Grid Gas (“NGG”). It will work with energy suppliers and networks to balance the UK’s electricity systems and will provide strategic oversight of the UK gas system by taking on longer-term planning in respect of gas (but not real-time operation, which will remain with NGG). The FSO will play a role in shaping the energy system and facilitating competition, overseeing new projects and integrating them with existing energy supplies, and in doing so will have a duty to facilitate net zero ambitions.

For now, the Government has clearly stated its intention to invest in both large-scale and smaller nuclear power. However, the financing models which are emerging to enable nuclear projects to get off the ground will involve an element of private investment too. For example, the Nuclear Energy (Financing) Act 2022 makes legislative provision for the use of the regulated asset base (“RAB”) model in new nuclear.

This collaborative, system-level approach may serve to assuage concerns of distribution network operators (“DNOs”), which are keen to see the approval of new investments in the gas grid, as Ofgem has been reluctant to endorse approvals in the past. Ofgem will undertake a new strategic function to oversee energy companies’

governance codes, ensuring that that the detailed technical and commercial rules which guide energy providers keep pace with the UK’s net zero ambitions and consumers’ needs.

Potential for Future Policy: **There are a number of points set out in the Strategy** which need to be developed further, and there will be future consultations and policies to deal with these points. For now, the Government has clearly stated its intention to invest in both large-scale and smaller nuclear power. However, the financing models which are emerging to enable nuclear projects to get off the ground will involve an element of private investment too. For example, the Nuclear Energy (Financing) Act 2022 makes legislative provision for the use of the regulated asset base (“RAB”) model in new nuclear, a model which requires a level of private investment as well as Government funding.

To ensure that financial models such as this are a success, there is an argument for the Government to go even further than what was announced to

ensure that nuclear is a commercial and investable proposition to private institutions. For example, this could be achieved through the inclusion of nuclear in the UK green taxonomy, or its inclusion in green bonds and issues around nuclear insurance. In addition, the following steps could be taken to ensure the success of nuclear projects in the future:

- Making land, including Nuclear Decommissioning Authority (“NDA”) land, available for project development.
- Granting pre-development funding to the Westinghouse-Bechtel project.
- Providing enabling policy support on siting, planning, insurance and licensing for advanced reactors.

Source: what-does-the-british-energy-security-strategy-mean-for-new-nuclear, 10 May, 2022

OPINION – Chan Kung

Deterrence, Intimidation and Propaganda under the Framework of Nuclear Equilibrium Arms Race

About 77 years have passed since 1945, and the development of nuclear weapons in various countries around the world has reached an astonishing scale today. According to the Federation of American Scientists, Russia has 5,977 nuclear warheads, devices that can trigger a nuclear explosion, including about 1,500 that have been retired and await dismantlement. The three nuclear-armed states of NATO have a total of 5,943 nuclear warheads, of which the US has 5,428, France 290, and the UK 225.

The rest of the world, including China, Pakistan, and India, has a combined total of 785 nuclear warheads. The two camps that were in a state of geopolitical confrontation during the Cold War have a total of 11,920 nuclear warheads, and their total number of nuclear warheads is basically the same. While this sounds alarming, since 1945, nuclear weapons have never actually been used on the

battlefield. The actual reason behind this is a subtle and dangerous balance of power that can be termed “nuclear equilibrium”. Its very existence has allowed the world to remain

peaceful under the looming shadow of large-scale nuclear expansion. I believe that in the future world, due to the ubiquity of geopolitical resources, nuclear equilibrium will continue to play a disincentive role very effectively.

In other words, nuclear equilibrium in global

geopolitics is a crucial concern for the actual use of nuclear weapons. Now, the West has jointly mobilized to impose all-rounded sanctions on Russia in the wake of the war in Ukraine. The scale of these sanctions far exceeds Russian President Putin’s expectations. This has of course, shocked and impacted Russia itself. Putin, in an effort to show that he is in charge of a major power, and one who holds true to his words, ordered Russia’s nuclear deterrence forces to be put on high alert, or as he called it, “special mode”. As a matter of fact, on the very same day when the invasion started, he warned that “whoever tries to stand in our way or create threats for our country...people should know Russia’s response will be immediate and lead you to consequences you have never encountered in your history”. The fact that he has ordered his military to fortify the 6,000-warhead arsenal is tantamount to being a major step towards launching a global thermonuclear war. Humanity has never seemed to feel the threat of nuclear war as clearly as it does today.

These are, as a matter of fact, mere “nuclear propaganda”. Putin’s order, of course, provides a good subject matter for the Western press. This is because, more often than not, we react instinctively and immediately to several specific themes, including death, sex, sin, and doomsday. As nuclear weapons are frequently associated with apocalyptic catastrophe in popular mind, countless imaginative narratives

instantaneously emerged in newspapers, television, and other forms of media around the world, instilling nuclear panic among us, as if nuclear war is at hand. However, this simply would not happen. This is not “nuclear deterrence” or even “nuclear intimidation”. It is merely “nuclear propaganda”. “Nuclear deterrence” means that the enormous power of nuclear weapons is used as a factor to prevent their actual use, i.e., a basis for bargaining.

In the actual application of nuclear deterrence, leaders who are well-prepared in their strategy would be less likely to intimidate others with nuclear weapons. It is like a familiar scene of the boy crying wolf in Aesop’s fable, that when false alarms were sounded too many times, it would only cause disbelief. What then, if nuclear weapons were actually fired? In reality, the usage of nuclear weapons does not require such intimidation. Regular and targeted signal monitoring of countries around the world would be sufficient enough to prevent this from happening, including the weapons that were launched accidentally. This has been the case since the beginning of the Cold War to the present day.

Therefore, nuclear deterrence is only used occasionally as a strategic tool. Frequent threats with nuclear weapons will only devalue the deterrence to a large extent. The problem is that even so, we can still see some ignorant state leaders who wield what is known as “nuclear intimidation”. Nuclear intimidation is not the same as nuclear deterrence. The former is a common practice of rogue states, used by their leaders as a tool to vent their emotions. Yet, these leaders know very well that either the nuclear weapons in their hands are insufficient against their enemies and themselves might be destroyed, as

in the case of North Korea, or that their nuclear weapons do possess the capability though at the same time, themselves could be annihilated as well, and such is the case of Russia. This is known as mutual assured destruction (MAD).

It should be pointed out that “nuclear equilibrium” is a powerful security mechanism that ensures that the risk is “controllable” if not truly “safe”. Our current world is in such a state of nuclear equilibrium, so to speak. Among the many nuclear-armed countries, only the number of nuclear weapons possessed by the US and Russia would be sufficient to cause the simultaneous destruction of both parties. As for other countries with nuclear weapons, they can at most cause partial destruction, and the country that created the first nuclear disaster could very well be destroyed by other countries soon afterward. As for Putin putting nuclear forces in “special mode”, it is actually not even “nuclear intimidation” but a kind of “nuclear

propaganda”. He did this not toward the outside world at all, but it was for the Russian public to see.

Hence, it is a form of propaganda. He wants his people to see the power of their leader, so as to maintain his own image. To put it more clearly, he wants to ensure the legitimacy of his political power. What he wishes to project is that no one else is bolder, stronger, and consequently more capable of defending Russia’s interests than himself. This makes it a kind of propaganda logic targeting the Russians, and this is also what Putin has to do now. That is not to say that nuclear threats do not exist in the world. In terms of nuclear weapons strategy, there is a doctrine known as “escalate to deescalate”. This doctrine says that if a more powerful weapon is unable to

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be used, a lesser one would be adopted instead. This is just a fringe theory, yet no one can guarantee that the use of nuclear weapons would not intensify in acts of retaliation. What is theoretical would remain theories, the world's nuclear equilibrium is still being maintained as of now. Although nuclear weapons have gradually spread to dozens of countries in the world, the often-neglected nuclear equilibrium has been the same for decades.

Source: <https://www.thejakartapost.com/opinion/2022/05/06/deterrence-intimidation-and-propaganda-under-the-framework-of-nuclear-equilibrium.html>, 07 May 2022.

OPINION – Mark Hillsdon

Will Ukrainian Crisis Help Bring Nuclear in from the Cold in Europe?

Even before Russian shells landed perilously close to the Zaporizhzhia nuclear power plant, the largest in Europe, the role of nuclear in the transition from fossil fuels was complicated. For many, memories of the nuclear disasters at Chernobyl and Fukushima are still fresh, yet at the same time, with Russian gas and oil no longer flowing freely to the West, others argue that nuclear is now more important than ever. Thirty-three countries operate nuclear reactors, among them Russia, China and the US, with France the largest player in Europe, which derived 25% of its electricity needs from nuclear in 2020. Finland has recently started up its first new reactor in over 40 years, while Poland is among a clutch of European states waiting to kick-start a nuclear industry. The UK, meanwhile, announced plans last month to increase nuclear capacity from 7GW to 24 GW by 2050. And France, which already depends on

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nuclear for 70% of its electricity, said in February it would reverse plans to shut down older reactors, and build another six new ones by 2050. But many countries have also eschewed the technology, among them Austria, Italy, Spain, Belgium and Germany, which vowed to close down its nuclear fleet by the end of 2022 after Fukushima.

While German Chancellor Olaf Scholz floated the idea of extending the lives of the country's last three nuclear plants as it scrambles to replace its heavy dependence on Russian fossil fuels, it is thought that it is more likely to restart some of its coal plants, while looking to import liquified natural gas from the US. Tom Greatrex, chief executive of the UK's Nuclear Industry Association, argues that not only is nuclear energy carbon-free, it also predictable, making it perfect for plugging the gap left by the intermittency of wind and solar, and providing the constant baseload that the grid

needs. This is why the International Energy Agency (IEA) and the IPCC have all included nuclear in their models and projections for a net-zero future, he explains. And in uncertain times, nuclear has a clear role to play in ensuring energy security and independence, too.

"The best time to build a nuclear power station was

10 years ago," Greatrex continues. "The second-best time is now." We need clean energy long into the future, he adds: "It's not as if decarbonisation stops in 2030." While nuclear power plants may generate power for decades afterwards – nearly 2.5 times longer than solar and wind plants, according to Karan Satwani, an energy analyst at Rystad Energy they take on average seven years to build, and the permitting process can take far longer. In the UK, the first new nuclear power plant to be built in 20 years, Hinkley Point C in Somerset,

In the UK, the first new nuclear power plant to be built in 20 years, Hinkley Point C in Somerset, was announced in 2008, but is now not expected to be completed until 2026, while construction costs have ballooned to 22-23 billion pounds. Similar projects in Flamanville, France and Olkiluoto, Finland have also significantly over run in terms of time and budget.

was announced in 2008, but is now not expected to be completed until 2026, while construction costs have ballooned to 22-23 billion pounds. Similar projects in Flamanville, France and Olkiluoto, Finland have also significantly over run in terms of time and budget.

In its energy strategy last month, the UK government announced hundreds of millions in new funding for nuclear and a new body, Great British Nuclear, to accelerate the development of new projects, saying it aimed to deliver up to eight reactors by 2030 "equivalent to one reactor a year, instead of one a decade." Whether that will win over nuclear critics remains to be seen. "Climate effectiveness means fast and cheap," says Mycle Schneider, an anti-nuclear activist who coordinates the annual World Nuclear Industry Status Report. "Nuclear power is slow and expensive. ... By the time this new generation of nuclear plants come online, it will be too late" to help meet 2030 targets to avoid catastrophic global warming. Critics also point to the fact that nuclear energy may be carbon-free. But the extraction, processing and transportation of uranium, produces emissions as does building and dismantling plants, and storing waste. Decommissioning nuclear plants, and the subsequent clean up, also considerably adds to their overall costs.

While nuclear receives scant mention in the European Commission's REPowerEU plan to turn off the tap on Russian fossil fuel imports, nuclear, along with natural gas, have been included in the new European Union taxonomy framework for what counts as sustainable investment. Thierry Breton, the EU's internal markets commissioner, has talked about the need to invest 550 billion euros (\$578.9 billion) in new nuclear if Europe is to be net zero by 2050 money that could be used not just to build new reactors, but reboot existing ones, too.

Rystad's Satwani says without new investment to replace and extend the lifetime of Europe's

existing power reactors, the EU will gradually lose a large share, perhaps half, of its nuclear power generation capacity by 2050. As a European Commission spokesperson told Ethical Corporation a day before the Russian invasion: "We need more renewables. They are cheaper, carbon-free and home-grown. (But) we also need a stable source – nuclear – and, during the transition, gas."

The UK is among those backing a new breed of SMRs, which are quicker and cheaper to build, and can even be housed inside existing coal-powered plants. In November, Rolls-Royce announced that it and two partners, BNF Resources and Exelon Generation, would invest 195 million pounds over the next three years,

In the USt, TerraPower, a startup co-founded by Bill Gates to revolutionise designs for nuclear reactors, is developing its first demonstration nuclear power plant in Wyoming. The plant, which will cost \$4 billion, with half of the money coming from the U.S. government, will be the first to use an advanced nuclear design called Natrium, which uses liquid sodium as a cooling agent instead of water.

helped by 210 million pounds in UK Research and Innovation funding, to deliver "a decarbonisation solution that will be available to the UK grid in the early 2030s". Each SMR power plant will have the capacity to generate 470 MW, equal to 150 onshore wind turbines, and provide baseload generation for 60 years, Rolls-Royce said.

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High-level nuclear waste can remain active for tens of thousands of years and, according to the World Nuclear Association, there is an estimated

250,000 tonnes of spent fuel worldwide, all currently stored above ground, often in cooling pools. Some is the legacy of early atomic development, much of it military, while high-level liquid waste, often the result of reprocessing, goes through a process of vitrification, when it is mixed with silica, to form a block of black glass, and then encased in concrete. Nuclear accidents in the past have led to the establishment of a global structure that closely monitors the entire cycle of nuclear power generation, explains Satwani of Rystad Energy, and “deep geological disposal is widely agreed to be the best solution for the final disposal of the most radioactive waste produced”.

Risks also remain in transporting the waste, and as yet none of these vast subterranean vaults, often hundreds of metres under the ground, have been opened, with few communities keen to have them on their doorsteps, no matter how deep the spent fuel is buried. But as the Russian strike near Zaporizhzhia reminded the world, the greatest risk of all is of a missile directly hitting one of Ukraine’s 15 nuclear power reactors, which generate half of its energy needs. Were that to happen, then the brighter future for nuclear would grow very dark indeed?

Source: <https://www.reuters.com/business/sustainable-business/will-ukrainian-crisis-help-bring-nuclear-cold-europe-2022-05-04/>, 04 May 2022.

NUCLEAR STRATEGY

NORTH KOREA

North Korea could ‘Pre-emptively’ Use Nuclear Weapons if Threatened, Kim Warns

North Korean leader Kim Jong Un warned again that the North could pre-emptively use its nuclear weapons if threatened, as he praised his top army

officials for a massive military parade in the capital, Pyongyang. Kim expressed “firm will” to continue developing his nuclear-armed military so that it could “pre-emptively and thoroughly contain and frustrate all dangerous attempts and

But as the Russian strike near Zaporizhzhia reminded the world, the greatest risk of all is of a missile directly hitting one of Ukraine’s 15 nuclear power reactors, which generate half of its energy needs. Were that to happen, then the brighter future for nuclear would grow very dark indeed.

threatening moves, including ever-escalating nuclear threats from hostile forces, if necessary,” the North’s official Korean Central News Agency said on 07 May. KCNA said Kim called his military officials to praise their work during Monday’s parade, where the North showcased the biggest weapons in its nuclear arsenal, including intercontinental ballistic missiles that could potentially reach the U.S. homeland. The North also rolled out a variety of shorter-range solid-fuel missiles designed to be fired from land vehicles or submarines, which pose a growing threat to South Korea and Japan.

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KCNA didn’t say when Kim’s meeting with military brass took place.

The parade marking the 90th anniversary of North Korea’s army came as Kim revives nuclear brinkmanship aimed at forcing the United States to accept the idea of his

country as a nuclear power and remove crippling economic sanctions. Speaking to thousands of troops and spectators mobilized for the parade, Kim vowed to develop his nuclear forces at the “fastest possible speed” and threatened to use them if provoked. He said his nuclear weapons would “never be confined to the single mission of war deterrent” in situations where the North faces external threats to its “fundamental interests.”

Kim’s comments suggested he would continue a provocative run in weapons testing to dial up the pressure on Washington and Seoul. South Korea will inaugurate a new conservative government in May that could take a harder line on Pyongyang following the engagement policies of outgoing

liberal President Moon Jae-in that produced few results. Kim's threat to use his nuclear forces to protect his country's ambiguously defined "fundamental interests" possibly portends an escalatory nuclear doctrine that could pose greater concern for South Korea, Japan and the US, experts say.

North Korea has conducted 13 rounds of weapons launches so far this year, including its first full-range test of an ICBM since 2017, while Kim exploits a favourable environment to push forward its weapons program as the U.N. Security Council remains divided and effectively paralyzed over Russia's war in Ukraine.

There are also signs that North Korea is rebuilding tunnels at a nuclear testing ground that was last active in 2017. Some experts say the North may try to conduct a new test sometime between the inauguration of South

Korean President-elect Yoon Suk Yeol on May 10 and his planned summit with U.S. President Joe Biden on May 21 to maximize its political effect.

U.S. State Department deputy spokesperson Jalina Porter said the US was aware of reports that North Korea could be preparing to conduct a nuclear test, which she said would be deeply destabilizing for the region and undermine the global non-proliferation regime. "We urge the DPRK to refrain from further destabilizing activity and instead engage in serious and sustained dialogue," she said, referring to North Korea by its formal name, the Democratic People's Republic of Korea. Kim's recent remarks followed a fiery statement released by his powerful sister earlier this month in which she blasted South Korea's defense minister for touting pre-emptive strike capabilities against the North. She said her country's nuclear forces would annihilate the South's conventional forces if provoked. Yoon, during his campaign, also talked about enhancing the South's pre-emptive strike capabilities and missile defenses. He also vowed to strengthen South Korea's defense in conjunction with its alliance with the US.

While Kim's collection of ICBMs has grabbed much international attention, North Korea since 2019 has also been expanding its arsenal of short-

range solid-fuel missiles threatening South Korea. The North describes some of those missiles as "tactical" weapons, which experts say communicates a threat to arm them with smaller battlefield nuclear bombs and proactively use them during conventional warfare to blunt the stronger conventional forces of South Korea and the US. About 28,500 U.S. troops are stationed in the South. North Korea may use its next nuclear test to claim that it has acquired the ability to build a small nuclear warhead to fit on those missiles or other weapons it recently tested, including a purported hypersonic missile and a long-range cruise missile, analysts say. Smaller warheads would also be necessary for the North's pursuit of a multi-warhead ICBM. ...

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Nuclear negotiations between Washington and Pyongyang have been stalled since 2019 because of disagreements over a

potential easing of U.S.-led sanctions in exchange for North Korean disarmament steps. Kim has stuck to his goals of simultaneously developing nuclear weapons and the country's dismal economy in the face of international pressure and has shown no willingness to fully surrender a nuclear arsenal he sees as his biggest guarantee of survival.

Source: Kim Tong-hyung, <https://globalnews.ca/news/8799524/north-korea-nuclear-weapons-use-warning/>, 30 April 2022.

BALLISTIC MISSILE DEFENCE

NORTH KOREA

N. Korea Fires a Likely SLBM, S. Korea Military Says

South Korean military said that North Korea fired what is believed to be a SLBM into the sea off its east coast around 0507 GMT on 07 May, from around Sinpo, where North Korea keeps submarines as well as equipment for test-firing SLBMs. Japan's defence ministry also tweeted that the projectile could be a ballistic missile. Japanese public broadcaster NHK, citing government sources, said the projectile landed outside Japan's exclusive economic zone.

On 04 May, North Korea fired a ballistic missile toward the sea off its east coast, South Korea and Japan said, after Pyongyang vowed to develop its nuclear forces "at the fastest possible speed". The US assessed that North Korea was preparing its Punggye-ri nuclear test site and could be ready to conduct a test there as early as this month.

Source: <https://www.france24.com/en/asia-pacific/20220507-n-korea-fires-likely-submarine-launched-ballistic-missile-s-korea-military-says>, 07 May 2022.

USA

Leidos Wins NCI Agency Contracts to Enhance Nato's BMD Capabilities

NATO Communications and Information (NCI) Agency has awarded two separate contracts to US-based company Leidos. The total value of the two single-awards, firm-fixed price contracts is approximately \$90m. In addition, each contract has a four-year base performance period along with additional maintenance services options of up to four years. The contracts aim to help enhance the alliance's BMD capabilities. As part of the contract terms, the company will lead an international team that will define the architecture of Nato BMD and develop requirements for the NATO command and control (C2) systems. Leidos will further integrate and evaluate the C2 systems along with operating, maintaining and upgrading the integration testbed (ITB) for Nato BMD.

... Both the contracts awarded to Leidos fall under NATO's BMD programme, which allows the NATO nations to act as a single unit and respond to the ballistic missile attacks. Headquartered in Brussels, Belgium, NATO's NCI Agency focuses on delivering advanced C4ISR technology to support the alliance's missions and address new

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challenges and threats. The agency is responsible for developing the BMD C2 capability required to protect NATO countries and territories against a ballistic missile threat along with the technology that allows NATO to plan, execute and monitor all air operations.

Source: <https://www.airforce-technology.com/news/leidos-nci-agency-nato-bmd/>, 09 May 2022.

NUCLEAR ENERGY

RUSSIA

Russia Suspended from OECD Nuclear Energy Agency

Russia's suspension from the OECD's Nuclear Energy Agency (NEA) will go into force today. The NEA is an intergovernmental organization meant to facilitate sharing of best practices and standards between countries which use civilian nuclear power. Together, its members account for roughly 85% of civilian nuclear capacity. The decision to suspend Russian membership was made by the OECD's ruling body, not the agency itself. It comes along with the termination of Russia's broader OECD membership application

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in response to its invasion of Ukraine. The NEA is not nearly as significant on the world stage as its sister organization, the IAEA, which continues to cooperate closely with the Russian government to prevent a nuclear

meltdown at captured Ukrainian plants. However, the NEA does ensure that its members have easy access to new civilian nuclear technologies and techniques and helps advance their nuclear energy sectors.

If Russian membership in the NEA remains suspended indefinitely, it—along with Western sanctions on Russia's nuclear sector—could cause Russia's nuclear industry to fall behind most others. If Russian nuclear technology

falls behind, it may no longer appeal to foreign buyers, which could jeopardize Russia's status as the world's largest exporter of civilian nuclear energy plants.

Source: <https://www.foreignbrief.com/daily-news/russia-suspended-from-oecd-nuclear-energy-agency/>, 11 May 2022.

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USA

US Working on Uranium Strategy, Weighs Ban on Russian Imports: Energy Secretary

US Energy Secretary Jennifer Granholm said on 05 May that the US was working on a strategy to ensure steady uranium supply and that the country should not be sending any more money to Russia. Republican Senator John Barrasso, the top Republican on the Senate energy committee, asked Granholm at a hearing on President Joe Biden's proposed FY2023 budget whether the president would ban imports of uranium used for US nuclear energy as a way to further weaken Russia. "I'll let the president make that statement but I can say that this is a point on which I think we have a lot of agreement. We should not be sending any money to Russia for any American energy or for any other reason," she said. She said the Energy Department is currently working on a broad uranium strategy to ensure steady uranium supply for US nuclear requirements.

Biden in March banned the import of Russian oil, natural gas, and coal, but not uranium. Russia is the third largest supplier of uranium in the US. The US power industry relies on Russia and its allies Kazakhstan and Uzbekistan for roughly half of the uranium powering its nuclear power plants.

It had been lobbying the White House to allow the imports despite Russia's invasion of Ukraine. Granholm said the US was working to ensure it can supply Low-Enriched Uranium to fuel existing

light water nuclear reactors. "If we move away from Russia right away, we want to make sure we have the ability to continue to keep the fleet afloat," she said. A full federal uranium strategy is going through the interagency review process, she said.

Source: <https://english.alarabiya.net/business/energy/2022/05/05/US-working-on-uranium-strategy-weighs-ban-on-Russian-imports-Energy-secretary>, 05 May 2022.

05/US-working-on-uranium-strategy-weighs-ban-on-Russian-imports-Energy-secretary, 05 May 2022.

NUCLEAR COOPERATION

FRANCE-INDIA

France and India Aim to Progress EPR Project in Coming Months

The French company EDF in 2021 submitted to NPCIL its binding techno-commercial offer to build six EPRs at Jaitapur in Maharashtra state and the project was among the bilateral issues backed during talks between President Emmanuel Macron and President Narendra Modi. The two leaders met at the Élysée Palace in Paris on 05 May, 2022 for wide-ranging talks on global security issues,

including events in Ukraine, as well as cooperation in space and action to tackle carbon emissions. A statement issued by President Macron's office after the talks said: "Both sides reaffirmed the commitment to the success of the strategic Jaitapur EPR project for access to reliable, affordable and low-carbon energy, and welcome the progress achieved over the last months. "They will increase the contacts in the coming months to achieve new progress."

The EDF offer includes the detailed technical configuration of the reactors, taking into consideration information on the site conditions, and the terms and conditions for the supply of

engineering studies and equipment for the six reactors. It is based on the complementary skills of EDF and NPCIL, and aims to build a long-term partnership between the French and Indian nuclear industries, EDF said last year.

The Jaitapur plant, with an installed capacity of

9.6 GWe, would be the most powerful nuclear power plant in the world, generating some 75 TWh per year, meeting the annual consumption needs of 70 million Indian households and avoiding the emission of an estimated 80 million tonnes of CO₂ per year, EDF said. NPCIL will be responsible for

the construction and commissioning of the units, as well as obtaining all necessary permits and consents in India as the owner and future operator of the plant. This includes certification of the EPR technology by the Indian regulator. EDF will not be an investor in the project, nor will it be in charge of construction, and with its partners will, in line with India's *Make in India* and *Skill India* initiatives, work to encourage Indian industrial involvement. India currently has 23 operable reactors, with eight more under construction.

Source: <https://www.world-nuclear-news.org/Articles/France-and-India-aim-to-progress-EPR-project-in-co>, 05 May 2022.

HUNGARY–RUSSIA

Hungary and Rosatom Push Ahead on Paks II Nuclear Project

Hungary says that Russia's Rosatom has given reassurances that "in terms of technology they are able to complete the project", with Foreign Minister Péter Szijjártó looking forward to the construction entering its next phase. According to a report posted on the Hungarian government website after a meeting between Szijjártó and Rosatom's director general Alexey Likhachev,

Szijjártó said that the project would make Hungary's energy supply "more secure and more predictable" at a time when global energy markets were facing "appalling challenges". The Hungarian Atomic Energy Authority is currently considering permit applications, with the minister saying that once the permits are issued "construction may enter its next phase".

Szijjártó said it was in Hungary's interest to increase its energy production, with nuclear energy "cheap, safe and environmentally friendly" and could help the country to meet its

environmental protection goals. In its own report on the meeting, Rosatom said: "Current issues relating to the project to construct the Paks II nuclear power plant were discussed at the meeting, as well as other Rosatom projects in Hungary. "The parties paid particular attention to fulfilling the key activities of the roadmap for the Paks II project for 2022-2023 and transitioning to the stage of constructing the plant. The two parties agreed to maintain regular dialogue." Nuclear energy is currently not subject to European Union sanctions, although earlier Rosatom was left

"extremely disappointed" after the termination of the contract for a new nuclear power plant in Finland.

Hungary has four nuclear units at Paks, which is 100 km south of Budapest. These are Russian-supplied VVER-440 pressurised water reactors, which started up between 1982 and 1987. The Paks II project was launched in early 2014 by an inter-governmental agreement between Hungary and Russia for two VVER-1200 reactors to be supplied by Rosatom, with the contract supported by a Russian state loan to finance the majority of the project. An application to build the containment building of the first new unit at Paks

The Jaitapur plant, with an installed capacity of 9.6 GWe, would be the most powerful nuclear power plant in the world, generating some 75 TWh per year, meeting the annual consumption needs of 70 million Indian households and avoiding the emission of an estimated 80 million tonnes of CO₂ per year.

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It was submitted in January. Project company Atomerômû Zrt said it should be approved within 150 days, which would be around the end of May.

The submission was “an important milestone” said Atomerômû Zrt, which is progressing the project and marks the first regulatory submission for a new nuclear building at the site. The containment building is the main structure at a nuclear power plant, housing the reactor itself as well as its vital coolant systems. It has a role in containing the radioactive materials within, while also protecting the reactor system from external hazards. The design of the containment building for the VVER-1200 is 72 metres high and spans a diameter of 52 metres. It features two walls of reinforced concrete designed to cope with extremes of temperature and weather as well as earthquake, flood and even aircraft impact and nearby explosions.

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The Hungarian licensing process involves an array of separate licences. Atomerômû Zrt already has permits to connect Paks II to the electricity grid, and in November last year gained approval to manufacture two reactor pressure vessels for the Paks II units. Some 18 buildings are already being built on the site in preparation for construction, as well as a concrete plant and a plant for rebar assembly.

Source: <https://www.world-nuclear-news.org/Articles/Hungary-and-Rosatom-push-ahead-on-Paks-II-nuclear>, 06 May 2022.

JAPAN–RUSSIA

Japan to Use Nuclear to Cut Dependence on Russian Energy: PM Kishida

Japan’s PM Fumio Kishida said that it would use nuclear reactors to help reduce its own and other countries’ dependence on Russian energy. Japan has become more reliant on Russian gas since

shutting down nuclear reactors after the 2011 Fukushima disaster in which an earthquake and tsunami triggered a meltdown, devastating its north-eastern region. But facing elections in July and rising energy prices that are squeezing voters’ budgets, Kishida said nuclear would be part of the country’s future energy policy. He said Japan would address the “vulnerability of our own energy self-sufficiency” by broadening where it buys energy from, promoting renewables and using nuclear power to diversify its sources of generation. ...

Source: <https://energy.economictimes.indiatimes.com/news/power/japan-to-use-nuclear-to-cut-dependence-on-russian-energy-pm-kishida/91364905>, 06 May 2022.

UK–JAPAN

UK and Japan PMs Announce Agreements on Defence and Radioactive Food

Boris Johnson and his Japanese counterpart Fumio Kishida announced new agreements at Downing Street, on deepening defence co-operation and the lifting of restrictions on food imports from Fukushima. The new defence deal will allow for British and Japanese troops to deploy together for training, joint exercises, and humanitarian relief missions. A UK government official said this Reciprocal Access Agreement highlighted the “UK’s commitment to the Indo-Pacific.” The deal will also deepen weapons development with Japan, with the pair to collaborate on the UK’s sixth-generation warplane – the Future Combat Air System programme.

It makes the UK the first European nation to have such ties with Tokyo and deepens Britain’s pivot towards the Indo-Pacific. Last year it was announced that the UK and US would collaborate with Australia to develop nuclear-powered submarines in what has become known as the

AUKUS military alliance. The remit of AUKUS was recently widened to include the development of nuclear-capable hypersonic missiles, much to the criticism of CND.

Food for Thought: Also announced was Food Standards Authority (FSA) plans for the removal of the remaining restrictions on food produce from Fukushima. In the wake of the 2011 nuclear disaster, Japan imposed strict restrictions on food coming from Fukushima prefecture. However, since 2019 it has called for a relaxation of the rules. Kishida later told a meeting in London's financial district that Japan would aim to restart its mothballed nuclear reactors – as a way to cut its reliance on oil and gas.

CND General Secretary Kate Hudson said: "The latest announcement of another British defence pact in the Indo-Pacific will only lead to a further escalation of tensions between nuclear-armed states. In addition to close collaboration on wargaming, Tokyo will participate in the development of new weapons systems such as a next-generation fighter. Considering the AUKUS pact was quickly expanded from nuclear-powered submarines to include the development of nuclear-capable hypersonic missiles, who is to know where weapons development with Japan will lead? What is known is that the UK is among those leading the charge in a new arms race in the region – at a time when taxpayers' money would be better used tackling growing austerity and energy insecurity at home."

Source: <https://cnduk.org/uk-and-japan-pms-announce-agreements-on-defence-and-radioactive-food/>, 07 May 2022.

USA-ARMENIA

US and Armenia Sign MOU on Civil Nuclear Cooperation

The USA and Armenia on 2 May signed a MOU concerning civil nuclear cooperation "enabling us

to deepen our strategic cooperation following on the gains made in connection with the US-Armenia Strategic Dialogue", the US State Department said. "This MOU improves our cooperation on energy security and strengthens our diplomatic and economic relationship." Secretary of State Antony Blinken signed for the USA and Minister of Foreign Affairs Ararat Mirzoyan signed for Armenia, during Mirzoyan's visit to Washington.

Kazakhstan's national uranium company reported that its production rose 1% on year in Q1, although attributable output declined 4%. Total sales volumes doubled in the period, reflecting the timing of customer-scheduled deliveries. Realized uranium prices were 33% higher. Natural uranium product coming from Kazakhstan accounts for more than 45% of the global primary supply.

... The statement added that Nuclear Cooperation MOUs "are diplomatic mechanisms that strengthen and expand strategic ties between the United States and a partner country by providing a framework for cooperation and a mutually aligned approach to non-proliferation on civil nuclear issues and for engagement between experts from

government, industry, national laboratories, and academic institutions". ... He added that Armenia appreciates US support for the reforms and also "support for developing Armenia's energy sector".

Source: <https://www.neimagazine.com/news/newsus-and-armenia-sign-mou-on-civil-nuclear-cooperation-9675799>, 05 May 2022.

URANIUM PRODUCTION

KAZAKHSTAN

Kazatomprom Raises Revenue Guidance as Uranium Price Surges

Kazakhstan-focused uranium miner Kazatomprom raised its 2022 revenue guidance, as geopolitical tensions and discussion of new nuclear projects spur higher prices. The world's largest uranium miner lifted its revenue forecast to KZT790-810 billion tenge (\$1.78-1.83 billion), up from KZT610-630 billion previously. Production and sales volume guidance for 2022 are unchanged. Kazakhstan's national uranium company reported that its production rose 1% on year in Q1, although attributable output declined 4%. Total sales volumes doubled in the period,

reflecting the timing of customer-scheduled deliveries. Realized uranium prices were 33% higher. Natural uranium product coming from Kazakhstan accounts for more than 45% of the global primary supply.

Geopolitical Tensions: The Russia-Ukraine conflict has deepened the ongoing nuclear fuel access concerns that began following the covid-related disruptions to uranium supply in 2020. Although there have been no restrictions imposed on nuclear fuel to date, negative sentiment has increased and legislative initiatives have been proposed by EU and US lawmakers to ban nuclear fuel imports from Russia. "The uncertain future availability of Russian fuel and processing services has brought concerns related to security of supply for western utilities, driving an increase in both spot and term market activity, putting significant upward pressure on natural uranium, conversion and enrichment prices," said Kazatomprom. "As a result of the geopolitical developments stemming from the Russia-Ukraine war, spot price rose to \$58.30/lb U_3O_8 , a level not seen since April 2011."

Source: <https://www.mining.com/kazatomprom-raises-revenue-guidance-as-uranium-price-surges/>, 03 May 2022.

USA

New Data on Uranium's Behaviour Revealed by Fastest Supercomputer in the US

An important but little-studied uranium compound could be key to a cleaner, safer world, according to new research emerging from the Oak Ridge National Laboratory, the Savannah River National Laboratory and the Colorado School of Mines.

In a paper published in *The Journal of Physical Chemistry C*, the scientists explain how they used the fastest supercomputer in the US to map the molecular vibrations of uranium tetrafluoride hydrate, or UFH, a by-product of the nuclear fuel cycle. UFH forms when uranium tetrafluoride, a radioactive salt routinely used in producing uranium metal, begins to break down after immersion in water for 12 hours or longer. Even though scientists have studied uranium and its

power to split the atom for nearly a century, most of those studies have focused on intentional results rather than unintended byproducts like UFH.

"From World War II through the Cold War, we have decades of study, but the main concern was making things work from a production standpoint, like building bombs and powering reactors," Andrew Miskowiec, lead author of the study, said in a media statement. "...Each of uranium's various molecular forms undergoes a unique set of vibrations, created by the dynamic motion of its atoms, that can act as a signature if scientists know what to look for. The research team used VISION, the world's highest-resolution inelastic neutron scattering spectrometer, to bombard samples with neutrons, monitor the energy lost or gained, and capture the full range of UFH's vibrations.

"For other common characterization techniques, we would have had to dissolve or otherwise destroy the sample to study it," Ashley Shields, co-author of the paper, said. "If we don't have a big sample to start with, we definitely don't want to destroy it before extracting as much information as possible. Spectroscopy gives us a way to gather data and preserve the sample for further analysis."

The Supercomputer at Play: Using the Oakridge lab's 200-petaflop IBM AC922 supercomputing system and applying density functional theory, a quantum-mechanical approach to estimating materials' structure, to model UFH's properties, the scientists were able to obtain the first complete picture of UFH's full vibrational spectrum for new insights into the compound's atomic structure. ...

The team used the data to compare the calculated vibrational spectrum to the experimental one measured at the lab's Spallation Neutron Source, allowing for atomic-level identification of spectral features in the experimental data. The study required more than 115,000 node hours to render the results. ...In other words, the findings may enable better detection of the environmental pollutant and a better understanding of how environmental conditions influence the chemical

behaviour of fuel cycle materials.

Source: <https://www.mining.com/new-data-on-uraniums-behaviour-revealed-by-fastest-supercomputer-in-the-us/>, 10 May 2022.

NUCLEAR PROLIFERATION

AUSTRALIA

Australia Considering Next-Generation US and UK Designs for Nuclear Submarines

Australia is involved in complex negotiations to ensure that its plan to acquire eight nuclear-powered submarines doesn't weaken the international non-proliferation regime. The chief of the Royal Australian Navy's nuclear-powered submarine taskforce, Vice Admiral Jonathan Mead, tells *The Strategist* talks are underway with the IAEA to ensure the project embraces such high safety standards that it sets a rigorous new benchmark under the Treaty on the Non-Proliferation Nuclear Weapons, or NPT. The submarines are to be built in Australia under the AUKUS arrangement with the US and UK. Australia is yet to choose a US or UK submarine, but reactors on both use highly enriched, and 'weapons grade', nuclear fuel that does not need to be replaced for the boat's 30-year life. There's concern that the use of this fuel could wreck the global non-proliferation machinery by opening the way for other nations to obtain it as a step towards manufacturing nuclear weapons. Mead is aiming for the RAN to have its first submarine by the end of the next decade, but says he's 'seized by the strategic need to drag that date left as much as is safely possible'. 'Given the deteriorating strategic situation, our assessment is that nuclear-powered submarines will remain a most formidable capability for decades. They provide significantly superior stealth, speed, firepower, survivability, manoeuvrability and endurance.' These submarines will also carry uncrewed underwater systems that might land special forces or clear a

The submarines are to be built in Australia under the AUKUS arrangement with the US and UK. Australia is yet to choose a US or UK submarine, but reactors on both use highly enriched, and 'weapons grade', nuclear fuel that does not need to be replaced for the boat's 30-year life.

minefield, and aerial systems. He notes that an interim submarine capability is likely to include Australians co-crewing with American and British submariners, and other more advanced options. Those options will not include another conventional submarine.

However, *The Strategist* understands that the navy may be offered a nuclear-powered boat to use through the 2030s—once Australia's nuclear stewardship has been certified. Mead says it's too soon to say whether Australia will end up with US Virginia-class or British Astute-class vessels, but he concedes that new versions, the American SSNX and the British SSNR, will be in the mix. 'We are doing deep-level analysis of all these options—maturity of the design, when are they going to start building it, what's its affordability, how we'd do it—to present by the first quarter of 2023 an optimal path to the three governments. We then begin to deliver the submarine.' 'To train personnel', Mead says, 'we could embed sailors

and officers in a US or UK boat to the point where we may have a 50% UK or US crew and a 50% Australian crew.' When the first submarine is launched in South Australia, the goal is to have the crew trained, the industrial base ready to maintain it and the

regulatory system set up. 'We have exchange officers on board our submarines and ships all the time.'

Mead visited UK and US training schools to check out their systems. Many crew members undertake reactor training and learn the fundamentals of nuclear physics, but they're not nuclear physicists. 'They've been given a six-month course, and then they go to sea and become competent and current on their tradecraft at sea in a submarine,' he says. 'So we need to set up a system supported by the US and UK to provide our people with reactor training. If you're the engineer, you may be a nuclear physicist. If you're working at the front end of the boat, you require some knowledge of the reactor in case there's an emergency, but not to the same level.'

'The commanding officer will require a very deep level. We are mapping out every person on the submarine and what type of nuclear training they require and how we deliver that.' Succeeding in the submarine enterprise will take a major national effort, says Mead.

... The Australian Defence Force needs to attract individuals who see nuclear-propelled submarines as state of the art, as exciting, as something they want to work in for many years. 'The challenge will be to make this an attractive workplace for people to leave school, undertake deep theoretical training, then have hands-on experience with the world's most advanced technologies, and stay in that program, as a civilian or in uniform,' he says.

...Mead needs thousands of specially trained people in the industrial base, navy workforce, broader ADF and crew from the sharp end of the submarine and the reactor through to safety regulation and monitoring and environmental protection and, 'if we have a defect, an Australian company that's nuclear certified and able to provide parts'. He's talking to universities that are developing courses ranging from doctoral and research degrees in nuclear physics down to graduate certificates or introductory courses on reactors.

His taskforce already numbers 226 specialists in areas ranging from engineering to international law and nuclear proliferation. Many have already been on global research trips. 'I have people embedded from the Attorney-General's Department and legal experts from the Solicitor-General, legal people from the navy and from the Department of Foreign Affairs and Trade, and we bring in other experts when needed.' The team will grow as required by the three nations. 'When we start building the submarine, we'll have a huge workforce in the yard, building and overseeing and regulating.'

So, where are these experts coming from? 'We've been overwhelmed with individuals and companies seeking to help,' Mead says. That

includes people living in Australia or abroad who have served on British or US nuclear-powered submarines or who've worked in the industry or on the regulatory side. ... To assess whether Australia could build these submarines without a civil nuclear industry, Defence sought advice from the US and UK. Because the reactors don't need to be refuelled and come as a sealed unit, the strong advice was that a civil industry was not required to build and operate the submarines. Mead has sought advice from nuclear physicists and technicians at the Lucas Heights reactor near

Sydney. 'They've been dealing with nuclear waste for many years, so we talk to them as we look at our own solutions for nuclear waste. 'We're continually embedding people in the US and UK training organisations and their workforces and seeing what they're doing in shipyards,

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talking to their legal people, embedding with the State Department.' They've looked at the vendors' industrial base to understand how they execute nuclear stewardship, and they've gone aboard submarines to get a better sense of what's required to run them and to maintain a reactor. A security specialist spent time with the US Naval Criminal Investigative Service.

US and British delegations visited South Australia to examine a Collins-class submarine in deep maintenance, and Mead will take a big team to UK shipyards soon to map out a pathway to Australia's new submarines. 'I wake up every morning thinking I've got to find that optimal pathway, not just to the submarine itself, but what is the optimal workforce?' says Mead. 'What's the best way to train these people over 20 years? How do we set Australian industry up for success? What are the best non-proliferation processes and policies we can put in place with the IAEA? What's the best stewardship to protect our people, the community and the environment? What are the best legal instruments we can develop that allow us to do this effectively and efficiently? How we will develop a sovereign capability.'

The plan for that whole system must be provided

to the three governments early next year so that the decision on the choice of submarine can be made. Then the process to build begins. In the US and UK, Mead says he's sensed an unwavering commitment from everyone he's talked to, civil and military.

'They see great strategic benefit in what we're doing. But they also appreciate that this will be an extremely challenging national and international endeavour and they give us very frank advice on the enormity of the task ahead. Not for one moment am I getting misty-eyed about that task.' Mead insists there'll be no design changes in the new submarine once it's chosen. 'Weapons systems may go from one country into another country's submarine. That's part of this trilateral contribution. Once that's done, though, there'll be no unique Australian design changes.' He says the boats must be built in Australia to ensure Australia has a sovereign capability. That will make it much easier to sustain them here. 'A builder may not be the sustainer, but decades of experience building submarines gives you a unique insight in how you sustain them.' Could Australia then become a sustainment hub for US and UK submarines? Absolutely, says Mead. A US nuclear submarine visited Western Australia recently and a British Astute-class boat came last year.

'Government has asked us to look at developing maintenance facilities in some of our ports. Over time, we can become a strategic sustainment hub for US Indo-Pacific Command or for the UK Ministry of Defence.' That could start with sustaining the 'front' of the boat, Mead says. 'As we develop our nuclear knowledge, we can look at facilities to work on the back of the boat as well. That may see Australia very much a partner with the US and UK in their submarine force posture.' The situation in Ukraine shows how uncertain large regions of the world are, he says. 'You need deterrents that

can meet the future strategic need.'

Source: *Brendan Nicholson, <https://www.aspistrategist.org.au/australia-considering-next-generation-us-and-uk-designs-for-nuclear-submarines/>, 10 May 2022.*

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After US Secretary of State Antony Blinken indicated that Iran had expedited its nuclear program, White House press secretary Jen Psaki expressed concern that Tehran may produce a nuclear weapon in weeks.

EU Making Last Ditch Attempt to Revive Iran Nuclear Deal: EU Representative Josep Borrell

The European Union has made a last-ditch attempt to save the controversial Iran Nuclear Deal and break a deadlock between Tehran and Washington. On 07 May, the bloc's Foreign Policy Chief Josep Borrell said that he was seeking a "middle way" to end the impasse which has continued ever since ex-US President Donald Trump pulled his country out of the deal. While talks resumed in 2021, they have been on hold since March, chiefly over Iran's insistence that Washington removes the

Islamic Revolutionary Guard Corps (IRGC) from the US Foreign Terrorist Organization (FTO) list.

Talking about the same, Borrell said that he was considering a situation in which the designation of the IRGC is removed but is sustained for other parts, including its arms and other businesses that it holds. Describing the aforementioned diplomatic effort as a "last bullet", he expressed his willingness to send EU negotiator Enrique Mora to visit Tehran. But he said that the Islamic Republic "was very much reluctant". ...

Iran may Produce Nukes within Weeks: US: After US Secretary of State Antony Blinken indicated that Iran had expedited its nuclear program, White House press secretary Jen Psaki expressed concern that Tehran may produce a nuclear weapon in weeks. During a press conference, Jen Psaki told reporters, "What Secretary Blinken said during his testimony this morning was that (Iran's) breakout period is down from about a year, which

is what we knew it was during the deal—to just a few weeks or less”, Newsweek reported. She further voiced her concern. “It worries us,” she said.

Source: Riya Baibhawi, <https://www.republicworld.com/world-news/rest-of-the-world-news/eu-making-last-ditch-attempt-to-revive-iran-nuclear-deal-eu-representative-josep-borrell-articleshow.html>, 08 May 2022.

US Negotiators Acknowledged Deal Beyond Nuclear Not Possible with Iran

The Biden administration’s negotiating team have reportedly acknowledged in private that an agreement that would go beyond curtailing Iran’s nuclear program is no longer possible. Politico cited multiple people familiar with classified Congress briefings on the subject that the two Iran-related motions passed in the Senate on 04 May, were a warning shot to the US team negotiating restoring the 2015 agreement with Tehran.

Although the motions were non-binding, the vote was seen as a test run of the bipartisan rebuke that would likely happen if Washington and Tehran clinch an agreement that does not address Iran’s non-nuclear activities and removes Iran’s Revolutionary Guard (IRGC) from the list of foreign terrorist organizations. The measures — that for the first time forced lawmakers to go on record about the key sticking points in the year-long negotiations in Vienna — were also hailed as modest victory for Republicans who have been urging the Biden administration to walk away from the talks, now in limbo for weeks now. The first vote was proposed by Senator Ted Cruz that called for maintaining terrorism-related sanctions on Iran’s Central Bank to limit Tehran’s cooperation for China, while the other — led by Senator James Lankford instructed Senate conferees to make sure that a House bill would include language that the Biden administration cannot remove the terror designation of the IRGC.

Source: [https:// www. iranintl.com/en/202205062935](https://www.iranintl.com/en/202205062935), 06 May 2022.

NUCLEAR SAFETY

GENERAL

Now Available: New IAEA Safety Guide on Protection Against Internal and External Hazards for Nuclear Power Plants

Helping countries enhance measures and improve processes to ensure the safety of nuclear power plants against internal and external hazards is the focus of an IAEA Safety Guide issued in April 2022. The Guide – Protection against Internal and External Hazards in the Operation of Nuclear Power Plants (SSG-77) – offers guidance on enhanced protection against internal and external hazards in nuclear power plants’ operations as well as updated recommendations based on lessons learned from incidents and accidents in nuclear power plants worldwide.

“Internal and external hazards, such as those induced by climate change,

are evolving, and some may pose elevated levels of threat to the operational safety of nuclear power plants. At the same time, the operators of nuclear power plants are enhancing their protection against the potential effects of internal and external hazards through diverse means such as physical barriers and operational safety measures,” said Anna Hajduk Bradford, Director of the IAEA Nuclear Installation Safety Division.

The publication includes specific recommendations for preparedness and response to prevent, protect and mitigate the effects of various hazards that may occur inside and outside nuclear power plants, such as fire or internal flooding, earthquakes, tsunamis, volcanoes, extreme weather, electromagnetic interference and combinations of these. One of the key elements covered is that while it might not be practical or possible to prevent a hazard or its impacts from triggering an anticipated operational

One of the key elements covered is that while it might not be practical or possible to prevent a hazard or its impacts from triggering an anticipated operational occurrence, hazard management should ensure that, to the extent practicable, a hazard does not trigger a more severe plant state, leading to accident conditions, such as fires that can result in failure of critical electrical cables, damage to safety systems as well as hardware failures, multiple safety system failures.

occurrence, hazard management should ensure that, to the extent practicable, a hazard does not trigger a more severe plant state, leading to accident conditions, such as fires that can result in failure of critical electrical cables, damage to safety systems as well as hardware failures, multiple safety system failures.

“All countries with nuclear power plants are encouraged to utilize this safety guide to conduct a self-assessment or to request assistance from the IAEA to identify potential gaps and continuously improve the plants’ resilience to internal and external hazards,” Bradford added.

The IAEA Safety Standards serve as a global reference for protecting people and the environment from the harmful effects of ionizing radiation. The aim of the SSG-77 is to contribute to that purpose by providing, together with other IAEA safety requirements and related recommendations, the best practices and approaches to address operational aspects for hazard protection and address applicable combinations of hazards.

Highlighting the importance of this publication, Bharat Patel, a user of the guide, who is a policy officer from the European Commission said: “Operating experience and data from European nuclear power plants show that the operators must be vigilant to various hazards, including fire.

The publication of the SSG-77 is timely since the next topical peer review in the frame of the European Union’s Nuclear Safety Directive will specifically address the subject of fire protection at nuclear installations.”

The recommendations in this Safety Guide are primarily for operating organizations of nuclear power plants and regulatory bodies. The recommendations are also of interest to other organizations involved in the design, construction, commissioning, operation and decommissioning of nuclear power plants, including technical support organizations, vendor companies such as designers, engineering contractors,

manufacturers, research establishments and universities providing services in support of a nuclear power plant, as well as organizations involved in mitigating such hazards. ...

Operational safety measures against these hazards include aspects such as defining roles and responsibilities of personnel, communication of forecast information inside and outside the plant, management of the effects of plant design changes, and training and exercises.

IAEA Safety Standards:

The IAEA Safety Standards provide a robust framework of fundamental principles, requirements, and guidance to ensure safety. They reflect an international consensus and serve as a global

reference for protecting people and the environment from the harmful effects of ionizing radiation.

Source: Aabha Dixit, <https://www.iaea.org/newscenter/news/now-available-new-iaea-safety-guide-on-protection-against-internal-and-external-hazards-for-nuclear-power-plants>, 04 May 2022.

UKRAINE

Update 68 – IAEA Director General Statement on Situation in Ukraine

Ukraine informed the IAEA that there had been no significant developments related to nuclear safety and security in the country over the past 24 hours, Director General Rafael Mariano Grossi said. Regarding the country’s 15 operational reactors at four nuclear power plants, Ukraine said seven are currently connected to the grid, including two at the Russian-controlled Zaporizhzhya NPP, two at the Rivne NPP, two at the South Ukraine NPP, and one at the Khmelnytsky NPP. The eight other reactors are shut down for regular maintenance or held in reserve.

Safety systems remain operational at the four NPPs, and they also continue to have off-site power available, Ukraine said. In relation to

In relation to safeguards, the IAEA said that the remote transfer of safeguards data from the Chernobyl NPP to the Agency’s Vienna headquarters is gradually being restored after its technicians upgraded the unattended monitoring systems installed at the site and deployed new transmission channels based on satellite technologies.

safeguards, the IAEA said that the remote transfer of safeguards data from the Chernobyl NPP to the Agency's Vienna headquarters is gradually being restored after its technicians upgraded the unattended monitoring systems installed at the site and deployed new transmission channels based on satellite technologies. The transmission from Chernobyl had been interrupted for two months. For the four operational NPPs in Ukraine, remote data is being transferred to the IAEA.

The shelling of the Zaporizhzhia plant, resulting in the destruction of a training laboratory adjacent to one of its six Soviet-built reactors, and represents the first time in history that an operating nuclear power plant had fallen under a sustained military attack.

Source: <https://www.iaea.org/newscenter/pressreleases/update-68-iaea-director-general-statement-on-situation-in-ukraine>, 30 April 2022.

UN Nuclear Watchdog Discusses Ukrainian Reactor Safety with Russian Nuclear Corporation

As tense conditions at Ukraine's Zaporizhzhya nuclear power plant continue, the UN's nuclear watchdog met with Russia's top nuclear official in hopes of assuring the safety of Europe's biggest atomic energy station as the Russian invasion drags on.

In a statement, Rafael Grossi of IAEA, stressed the urgency of ensuring safety at the plant and emphasized the IAEA's "readiness to play its indispensable role" at a May 4 Istanbul meeting. Rosatom acknowledged the meeting in a statement of its own, saying that CEO Alexei Likhachev had discussed the safety of Ukrainian nuclear facilities "under [the] current complicated circumstances." Neither statement disclosed the details of the discussion — but the fact that they took place offers a clear indication that Rosatom considers itself the steward of the Zaporizhzhya plant, which Russian forces stormed in a dramatic assault on March 4, a few days into their unprovoked

The IAEA has criticized this arrangement, saying in a report published that "the presence of Rosatom staff could lead to interference with the normal lines of operational command or authority, and potential frictions when it comes to decision-making.

incursion into Ukraine.

Grossi has repeatedly asked to visit the plant with IAEA experts for a safety check, but those plans appear not to have been discussed at the meeting with Likhachev. The shelling of the Zaporizhzhia plant, resulting in the destruction of a training laboratory adjacent to one of its six Soviet-built reactors, and represents the first time in history that an operating nuclear power plant had fallen under a sustained military attack. Since Russian troops occupied the plant, they have held the Ukrainian operators hostage, forcing them to work arduous hours at gunpoint while answering to a handful of Russian specialists imported to the war zone from Rosatom.

The IAEA has criticized this arrangement, saying in a report published that "the presence of Rosatom staff could lead to interference with the normal lines of operational command or authority, and potential frictions when it comes to decision-making." But Rosatom's presence at the plant seems to assume that Russia's forces will eventually envelope the Zaporizhzhya Oblast in southeastern Ukraine, where the plant is located, eventually making the plant itself a spoil of war. It also positions Rosatom itself as a tool of Moscow's invasion. Ukraine operates 15 nuclear reactors of Soviet design that are arrayed throughout four nuclear power plants — thought the Zaporizhzhya plant's location nearby fighting in the neighbouring Donbas region have situated it in the crosshairs of Russian forces.

The IAEA's Grossi had visited the Chernobyl nuclear power plant after it had been occupied by Russian forces for 35 days. Since the withdrawal of Russian troops from the infamous site of the world's worst nuclear catastrophe, alarming reports have surfaced

reflecting a disregard for nuclear safety by Russian soldiers. According to the IAEA's statement, seven of Ukraine's reactors are currently connected to the electricity grid, with the remainder held in reserve.

Source: <https://bellona.org/news/nuclear-issues/2022-05-un-nuclear-watchdog-discusses-ukrainian-reactor-safety-with-russian-nuclear-corporation>, 06 May 2022.

NUCLEAR WASTE MANAGEMENT

GENERAL

IAEA Publishes Safe Solutions for Disposing of Radioactive Waste

Safe and effective solutions for disposing of radioactive waste are available today. But implementing them requires the understanding and support of stakeholders, including government officials (national, regional and local), industry, trade and environmental organizations, local communities and the general public. Communication and Stakeholder Involvement in Radioactive Waste Disposal (Nuclear Energy Series No. NW-T-1.16), the IAEA's latest publication addressing communications and outreach efforts on nuclear energy, describes how to interact with key stakeholders to successfully dispose of radioactive waste, including the high level and long lived radioactive waste arising from nuclear power plants.

... Radioactive waste needs to be safely disposed of. High-level waste, which represents only a minute fraction of all radioactive waste but has the potential to be hazardous for hundreds of thousands of years, needs to be disposed of in deep underground in geological repositories. The science underpinning such sites is well developed,

with Finland set to begin operating the world's first such facility in the coming years. But how can authorities and waste management organizations build the social trust needed to site and host a deep geological repository?

Part of the answer is stakeholder engagement. This new IAEA publication is based on years of cumulative experience from successful, and not so successful, engagement strategies. And while there can be no single engagement template as every country has its unique context, this publication provides an understanding of the

factors that contribute to effective stakeholder engagement for a successful disposal programme. Central to engagement is dialogue, a two-way conversation allowing interest groups to make their views and concerns known and heard, and allowing authorities and waste management organization to explain the factors on which any decision is based. This process results in better mutual understanding and contributes to building greater confidence and trust in the solutions to be implemented. ...

Source: <https://www.devdiscourse.com/article/technology/2027359-spacex-capsule-splashes-down-bringing-4-astronauts-home-from-6-month-mission>, 06 May 2022.

Upon 30th Anniversary of Chernobyl, ShelterZoom Announces Blockchain-based Solution for Management of Nuclear Waste on A Global Scale

As the world observes the 30th anniversary of Chernobyl, ShelterZoom, Unite For Italy and Morichi Atelier announce the launch of the world's first nuclear waste management use case for blockchain-based distributed ledger technology. This endeavour, dubbed "Hercules", developed as

As the world observes the 30th anniversary of Chernobyl, ShelterZoom, Unite For Italy and Morichi Atelier announce the launch of the world's first nuclear waste management use case for blockchain-based distributed ledger technology. This endeavour, dubbed "Hercules", developed as a part of the MICADO European project and funded by the European Union's Horizon 2020 research and innovation program, aims to protect and secure all "digi-waste" (digital nuclear waste) sensitive data and digi-waste management operations through a powerful multi-functional platform.

a part of the MICADO European project and funded by the European Union's Horizon 2020 research and innovation program, aims to protect and secure all "digi-waste" (digital nuclear waste) sensitive data and digi-waste management operations through a powerful multi-functional platform.

This innovative idea stemmed from Unite for Italy (a non-profit impact initiative) and was facilitated by Morichi Atelier, a boutique advisory firm, that identified a potential 30M USD market opportunity in the digi-waste sector. The Hyperledger blockchain "Hercules" collaboration with ShelterZoom aims to fix the outdated management and data protocols of the nuclear decommissioning and dismantling phases. The potential vulnerabilities caused by security breaches and/or human error can be largely prevented with this efficient digital solution.

Until today, the physical data collected in analysis stages has not been fully secured through sufficient infrastructure ensuring data protection during waste characterization analysis. To solve the problem and eliminate any form of human error, the MICADO project developed a series of interconnected smart instrumentations to digitalize, process, and link all sensitive information to its protected internal cloud servers. These new systems are able to scan, measure, and track any form of radioactive elements (barrels, containers, bags, and any other radioactive material) in a much more secure and efficient manner. What was processed before via paper documents is now being immediately digitized through the use of technology marking the beginning of a new age for the industry called "digi-waste".

The innovative partnership between ShelterZoom, Unite For Italy and Morichi Atelier brings together a cutting-edge SaaS technology provider, a non-profit impact initiative aiming to drive advocacy for other impact initiatives, and a boutique sustainable development consulting firm to provide solutions for one of the most difficult issues the nuclear industry faces: data security in waste management. The team plans to develop

a fully comprehensive roadmap to provide technology-oriented results that enhance the protection of nuclear data, sensitive information, and management procedures aimed at the resolution of the bigger issues at hand. By creating a more sustainable world, furthering a change in people's perspectives regarding this energetic sector and paving the way for more companies to use their know-how to make a difference, ShelterZoom and Morichi Atelier have started building the first digitally-secure and fully scalable model that can accommodate the dozens of players in the nuclear waste management landscape.

About ShelterZoom Corp: ShelterZoom, is a leading provider of enterprise-level blockchain-based Smart Documents, Smart Contracts and Blockchain API integration services. The blockchain-based SaaS software company was founded in 2017, servicing large enterprises, government agencies, law firms, non-profits, the publishing industry, academic institutions, real estate and small businesses with fully supported blockchain smart document applications, tokenization and digital asset solutions. As part of the company's commitment to improving the lives of people around the world ShelterZoom is a member of Humanity 2.0, an international consortium of organizations supporting human flourishing, and, as a signatory of the United Nations Global Compact, has several tools to support the UN's Sustainable Development Goals.

About Morichi Atelier LLC: Morichi Atelier LLC is built with the commitment to develop a better tomorrow, today. The company, overseeing business development, technological innovation, environmental, philanthropic, and impact investment horizons, helps to transform ideas of development into solid plans of actions for all clients in the areas of its expertise; this happens through a series of project ventures with external partners that share the business philosophy, circular economy ideas, and sustainable impact. At the heart of Morichi Atelier is the core belief that today's companies have to be built to create a better future for our global society and our planet following ESG principles, circular economy action

plans, and sustainable business models based on impact. All projects pursued, developed singularly or through the joint effort of our partners, try to integrate as much as possible the UN SDG program; Morichi Atelier's vision translates those strong values into tangible applications to resolve some of the complex problems present in its

operational fields while generating solutions with a high level of sustainable impact.

Source: <https://www.digitaljournal.com/pr/upon-30th-anniversary-of-chernobyl-shelterzoom-announces-blockchain-based-solution-for-management-of-nuclear-waste-on-a-global-scale>, 05 May 2022.



Centre for Air Power Studies

The Centre for Air Power Studies (CAPS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Marshal Anil Chopra, PVSM AVSM VM VSM (Retd).

Centre for Air Power Studies

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