



OPINION – Manpreet Sethi

Vol 18, No. 08, 15 FEB. 2024

The Contemporary Buzz Around Nuclear Energy

Like the tides of the ocean, nuclear energy too has seen its highs and lows from the time that commercial generation of electricity from nuclear reactors started in the mid-1950s. The last ebb came after the accident at Fukushima in 2011 whereafter a phase of scepticism about nuclear safety led many countries to pause or slowdown their nuclear power plans. The mood, however, seems to be changing, largely owing to the recognition of the urgent need for energy transition to low-carbon sources as a way of addressing climate change concerns. Three recent developments indicate this trend.

The first of these was the last UN Climate Change Conference, called the Conference of Parties (COP), that took place in Dubai in November 2023. At this meeting, the 28th since the first COP took place in 1995, nations took the first-ever pledge to phase down fossil fuel use. Towards this objective, more than one hundred countries pledged to triple renewable energy capacity by 2030. But, it is even more interesting that 22 countries signed a declaration to triple global nuclear energy capacity over the next 25 years to meet climate goals to reach net zero emissions by 2050. The IAEA effectively used the COP to press its idea of 'Atoms4NetZero' in support of

The IAEA effectively used the COP to press its idea of 'Atoms4NetZero' in support of nuclear energy for climate mitigation. For the first time, the COP-28 final document included support for investments in nuclear energy amongst other low-emission technologies, a privilege earlier offered only to renewable energy technologies.

CONTENTS

- ☛ OPINION
- ☛ NUCLEAR STRATEGY
- ☛ NUCLEAR ENERGY
- ☛ BALLISTIC MISSILE DEFENCE
- ☛ SMALL MODULAR REACTORS
- ☛ NUCLEAR COOPERATION
- ☛ URANIUM PRODUCTION
- ☛ NUCLEAR PROLIFERATION
- ☛ NUCLEAR SAFETY
- ☛ NUCLEAR WASTE MANAGEMENT

nuclear energy for climate mitigation. For the first time, the COP-28 final document included support for investments in nuclear energy amongst other low-emission technologies, a privilege earlier offered only to renewable energy technologies.

A second event where the spotlight shone on nuclear energy was the World Economic Forum (WEF) at Davos that took place from January 15-19, 2024. An annual assembly of global thought leaders, the forum provides a platform to discuss pressing global issues. Climate, energy and nature were one of the main themes at this year's meeting

which included a discussion on technologies to ensure clean energy transition. In an attempt to broaden the energy focus at WEF, the IAEA DG drew attention to the role that nuclear energy could play in combatting climate crises while ensuring energy security. A lunch session on January 16, 2024, was devoted to the topic of new nuclear technologies, such as small modular reactors and fusion technology, and the conditions necessary to make them realise their potential. Drawing the attention of the business leaders to these developments can help channel the flow of investments into the nuclear sector. To further this cause, the IAEA has also teamed up with the government of Belgium to hold a World Nuclear Energy conference in March 2024, particularly to call for providing a level playing field for nuclear energy alongside other low-carbon sources of electricity production.

A third topical development that has raised the buzz around nuclear energy is the release of 'Electricity 2024' by the International Energy Agency in January 2024. This annual publication forecasts electricity demand and supply, and CO2 emissions. This year's edition provides a forecast up to 2026. It estimates that global electricity demand would grow at a faster rate over the next three years as compared to the reduced electricity demand in 2023 due to falling electricity consumption in advanced economies. Over the next three years, it is expected that electricity demand would jump from 2.2 per cent in 2023 to an average of 3.4 per cent during 2024-2026. China, India and countries in Southeast Asia are expected to lead this demand. In fact, India's demand for electricity is

galloping. It grew by 7 per cent in 2023 and is expected to continue to grow at 6 per cent for the next three years.

Over the next three years, it is expected that electricity demand would jump from 2.2 per cent in 2023 to an average of 3.4 per cent during 2024-2026. China, India and countries in Southeast Asia are expected to lead this demand. In fact, India's demand for electricity is galloping. It grew by 7 per cent in 2023 and is expected to continue to grow at 6 per cent for the next three years.

expected to grow from 40% of global electricity generation in 2023 to 50% by 2026. In fact, nuclear power generation is forecast to reach an all-time high globally by 2025, "as output from France climbs, several plants in Japan are restarted, and new reactors begin commercial operations in many markets, including in China, India, South Korea and Europe. In fact, the share of Asia's nuclear generation is expected to reach 30% of global generation in 2026.

While renewables are expected to make up more than a third of total generation by 2025, nuclear energy too is expected to grow from 40% of global electricity generation in 2023 to 50% by 2026. In fact, nuclear power generation is forecast to reach an all-time high globally by 2025, "as output from France climbs, several plants in Japan are restarted, and new reactors begin commercial operations in many markets, including in China, India, South Korea and Europe.

It is also anticipated that as these nations prioritise the transition to clean energy, their additional electricity demand would be covered by technologies that produce low emissions. While renewables are expected to make up more than a third of total generation by 2025, nuclear energy too is expected to grow from 40% of global electricity generation in 2023 to 50% by 2026. In fact, nuclear power generation is forecast to reach an all-time high globally by 2025, "as output from France climbs, several plants in Japan are restarted, and new reactors begin commercial operations in many markets, including in China, India, South Korea and Europe. In fact, the share of Asia's nuclear generation is expected to reach 30% of global generation in 2026.

The Urgent Necessity for Low-Carbon Electricity Generation: The surge in nuclear electricity generation is expected to come from the compulsion to meet the hunger for electricity through low-carbon sources. In fact, unless this is ensured, the world has no chance of meeting the climate change goals that it has set for itself. It may be recalled

that in 2015, the international community adopted the Paris Agreement on climate change, pledging to hold the increase in global average temperature to less than 2°C above pre-industrial levels, and if possible, to limit it to 1.5°C. Sadly, this objective appears shaky since the Earth's global average surface temperature was reported to be more than 2°C higher than pre-industrial levels in November

2023 for the first time, making it the hottest year on record. Global and North Atlantic sea-surface temperatures too broke records, and Antarctic sea ice reached its lowest daily extent since the advent of satellite data. Interestingly, this news came when COP 28 was in session!

As is evident from the statistics that is pouring in, climate change is here and now. It is a major threat to humanity and the experience of the severity and frequency of adverse natural disasters has made nations sufficiently cognisant of the fact to be persuaded to make ambitious commitments. But, insufficient implementation of commitments owing to geopolitical or economic reasons remains a major hurdle. For instance, the world invested a record-breaking US\$1.7 trillion in clean energy in 2023. But, this was offset by nearly US\$1 trillion investment in fossil fuel which countries were unable to avoid for political and economic reasons. In short, current efforts to reduce GHG emissions remain less than sufficient to arrest climate change. More efforts will have to be devoted towards refashioning activities that are emitting the largest amount of greenhouse gases. And, electricity generation tops this list.

Electricity generation is responsible for close to 40% of the global CO2 emissions produced by the energy sector, the other 60% or so is generated primarily through the use of fossil fuels in industry, heating in buildings and transport. Hence the urgent need for moving away from fossil fuel sources, which are the biggest culprits on this front. In fact, not only is electricity generation from fossil fuels amongst one of the highest contributors to GHG emissions, it is also one factor whose transformation could have a bearing on all other activities. Since modern-day economic

growth and development are so tightly coupled with electricity, it becomes imperative that electricity generation takes place not just through safe and secure sources, but also from those that best sustain the environment. This requires ambitious efforts to transform the energy sector from fossil fuel production and use, which is the main source of carbon dioxide (CO2), to carbon-neutral sources.

Renewables and Nuclear:

Renewables (particularly hydro, solar, wind) and nuclear fission are amongst the low-carbon sources available for electricity generation. While hydroelectricity has been generated for a long time, it suffers from the handicap of being available only in specific locations. Also, the appetite for large hydro projects has significantly reduced owing to problems of displacement and rehabilitation that have lingered over decades.

Meanwhile, solar and wind energy have emerged as the new favourites and the last decade has seen a phenomenal jump in electricity produced using these sources. Heavily subsidised and incentivised by governments, the cost of this electricity too has

fallen over the years. However, their biggest drawback is that they are unable to provide electricity grids with stable, resilient and dispatchable power to maintain a non-stop flow of energy. It has, therefore, been necessary to support fossil fuel plants with backup options to provide this stability. These have mostly been coal, oil or gas-fired plants. Given that they emit GHG emissions, it reduces the possibility of solar and wind energy being able to contribute towards achieving net zero emissions by themselves, even though they would make a substantial contribution.

It is in this context that the importance of nuclear

For instance, the world invested a record-breaking US\$1.7 trillion in clean energy in 2023. But, this was offset by nearly US\$1 trillion investment in fossil fuel which countries were unable to avoid for political and economic reasons. In short, current efforts to reduce GHG emissions remain less than sufficient to arrest climate change.

Renewables (particularly hydro, solar, wind) and nuclear fission are amongst the low-carbon sources available for electricity generation. While hydroelectricity has been generated for a long time, it suffers from the handicap of being available only in specific locations.

energy as a baseload source of electricity that can effectively meet clean energy transition goals stands out. When comparing the cradle-to-grave journey of sources of electricity, nuclear energy has the lowest carbon footprint, and uses fewer materials and land. To illustrate, solar power needs more than 17 times as much material and 46 times as much land to produce one unit of energy.

When comparing the cradle-to-grave journey of sources of electricity, nuclear energy has the lowest carbon footprint, and uses fewer materials and land. To illustrate, solar power needs more than 17 times as much material and 46 times as much land to produce one unit of energy. The power density of nuclear energy beats all other renewables.

The power density of nuclear energy beats all other renewables. According to one estimate, "A solar farm needs between 5 and 50 times more land to generate as much electricity as an equivalent coal-powered plant, and a wind farm needs ten times more than solar." Put another way, nuclear plants can generate 500-1000 watts per sq mtr while solar is at 5-20 and wind at 1-2 watts per sq mtr. Bill Gates emphasises that nuclear plants rank the highest in efficiently using materials like cement, steel and glass, which are electricity guzzlers themselves in their manufacturing processes.

Nuclear plants use much less material per unit of electricity generated compared to others. In fact, solar photovoltaics are the least efficient followed by hydropower and wind. This is an important consideration when accounting for the GHG

Nuclear plants use much less material per unit of electricity generated compared to others. In fact, solar photovoltaics are the least efficient followed by hydropower and wind. This is an important consideration when accounting for the GHG emissions produced in the manufacture of this material.

emissions produced in the manufacture of this material. As aptly put by Grossi, DG of IAEA, "To be pro-nuclear is to take our long-term responsibility to this planet and its future generations seriously."

Besides decarbonising electricity production, the use of nuclear power can also decarbonise two other processes that use energy: heating in industry and of buildings through direct utilisation of steam, and producing low-carbon hydrogen for transportation. Thus, it is anticipated that nuclear

energy can be used to produce hydrogen on a massive scale and at an increasingly competitive cost, which would be a clean heat and transportation source of the future. The potential of nuclear energy for these applications would also be crucial for reaching net zero through the development and deployment of low-carbon options.

In fact, enhancing energy production and sustaining

the environment is not an either/or choice. The world needs both. Governments owe it to their citizens to provide them with electricity while also ensuring the best quality of life from their health and environmental perspective. If economic development and decarbonisation have to be simultaneously pursued, nuclear power can offer a viable alternative to fossil fuels that must be prudently built and safely operated.

But, will nuclear energy be able to realise its perceived potential in the coming years? What are the head and tailwinds that it is likely to face? Where is it likely to grow? Which technologies are likely to reach fruition? How can one address public perceptions on nuclear safety? Where does India see nuclear energy in its own energy mix? The forthcoming monthly issues

of 'NuClearly Put' in the year 2024 will examine these questions one by one to offer some clarity.

Source: <https://capsindia.org/the-contemporary-buzz-around-nuclear-energy/>, 31 January 2024.

OPINION – Norman Solomon

We still have Far to Go to Put the Breaks on the Nuclear Arms Race

What passes for debate on Capitol Hill is routinely an exercise in green-eyeshade discourse, assessing the most cost-effective outlays to

facilitate Armageddon. Yes, the Doomsday Clock keeps ticking—it's now at 90 seconds to midnight, according to the Bulletin of the Atomic Scientists—but the ultimate time bomb never gets the attention that it deserves. Even as the possibility of nuclear annihilation looms, this century's many warning signs retain the status of Cassandras. Presidents Bush and Trump withdrew the US from vital pacts between the U.S. and Russia, the two nuclear superpowers, shutting down the Anti-Ballistic Missile, Open Skies, and Intermediate-Range Nuclear Forces treaties. And despite promising otherwise, Presidents Obama and Biden did nothing to revive them.

Under the buzzword "modernization," the American government, a thermonuclear colossus, spent \$51 billion last year alone updating and sustaining its nuclear arsenal, gaining profligate momentum in a process that's set to continue for decades to come. "Modernizing and maintaining current nuclear warheads and infrastructure is estimated to cost \$1.7 trillion through Fiscal Year 2046," the office of Senator Markey (D-Mass.) pointed out, "while the Congressional Budget Office anticipates that current nuclear modernization would cost \$494 billion through Fiscal Year 2028."

Such bloated sums might prove a good argument against specific weapons systems, but Uncle Sam has incredibly deep pockets for nuclear weaponry and a vast array of other military boondoggles. In fact, compared to the costs of deploying large numbers of troops, nuclear weapons can seem almost frugal. And consider the staggering price of a single aircraft carrier that went into service in 2017, the Gerald R. Ford: \$13.3 billion.

Under the buzzword "modernization," the American government, a thermonuclear colossus, spent \$51 billion last year alone updating and sustaining its nuclear arsenal, gaining profligate momentum in a process that's set to continue for decades to come.

Militarism's overall mega-thievery from humanity has long been extreme, as President Eisenhower made clear in a 1953 speech: Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This world in arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children.

Militarism's overall mega-thievery from humanity has long been extreme, as President Eisenhower made clear in a 1953 speech: Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This world in arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children.... This is not a way of life at all, in any true sense. Under the cloud of threatening war, it is humanity hanging from a cross of iron.

The Nuclear Complex and "Crackpot Realism": In the case of budgets for nuclear arms, the huge price tags are—in the most absolute sense imaginable—markers for a sustained, systemic, headlong rush toward omnicide, the destruction of the human species. Meanwhile, what passes for debate on Capitol Hill is routinely an exercise in green-eyeshade discourse, assessing the most cost-effective outlays to facilitate Armageddon, rather than debating the wisdom of maintaining and escalating the nuclear arms race in the first place. Take, for instance, the recent news on cost overruns for the ballyhooed Sentinel land-based missile system, on the drawing boards to replace the existing ICBMs in 400 underground silos located in Colorado, Montana, Nebraska, North Dakota, and Wyoming. Northrop Grumman has already pocketed a \$13.3 billion contract to begin moving the project forward. But the costs have been zooming upward so fast as to set off alarm bells in Congress, forcing a reassessment.

"The U.S. Air Force's new intercontinental ballistic missile program is at risk of blowing past its initial

\$96 billion cost estimate by so much that the overruns may trigger a review on whether to terminate the project," Bloomberg News reported in mid-December. Since then, the estimated overruns have only continued to soar. Last month, Northrop Grumman disclosed that the per-missile cost of the program had climbed by "at least 37%," reaching \$162 million—and, as Breaking Defense noted, Defense Secretary Lloyd Austin would need to "certify the program to stave off its cancellation."

The re-emerging ICBM controversy is yet another high-stakes example of the kind of gauntlet that disarmament advocates regularly face in official Washington, where presenting an analysis grounded in sanity is almost certain to be viewed as "not realistic." At one level, cancellation would vindicate the approach taken by disarmament-oriented groups a couple of years ago when they tried to stop the creation of the Sentinel by arguing that it would be a "money pit missile." But at a deeper level, the cost argument—while potentially a winner for blocking the Sentinel—is a loser when it comes to reducing the dangers of nuclear war, which ICBMs uniquely boost as the land-based part of this nation's nuclear triad.

As Ellsberg and I wrote in *The Nation* in 2021, "If reducing the dangers of nuclear war is a goal, the top priority should be to remove the triad's ground-based leg—not modernize it." Eliminating ICBMs would be a crucial step when it comes to decreasing those dangers, because "unlike the nuclear weapons on submarines or bombers, the land-based missiles are vulnerable to attack and could present the commander in chief with a sudden use-them-or-lose-them choice." That's

why ICBMs are on hair-trigger alert and why defeating just the Sentinel would be a truly Pyrrhic victory if the purported need for such land-based missiles is reaffirmed in the process.

The re-emerging ICBM controversy is yet another high-stakes example of the kind of gauntlet that disarmament advocates regularly face in official Washington, where presenting an analysis grounded in sanity is almost certain to be viewed as "not realistic."

In theory, blocking the Sentinel by decrying it as too expensive could be a step toward shutting down ICBMs entirely. In practice, unfortunately, the cost argument has routinely led to an insistence that the current Minuteman III ICBMs could simply be upgraded and continue to serve just as well—only reinforcing the assumption that ICBMs are needed in the first place.

The author of the pathbreaking 2022 study "The Real Cost of ICBMs," Foley, is now a colleague of mine at RootsAction.org, where she coordinates the Defuse Nuclear War coalition's new campaign to eliminate ICBMs. "News of dramatic cost overruns on the Sentinel program is unsurprising, but I don't think that in itself should encourage disarmament advocates," she told me recently. "Cancellation of the Sentinel program does not equal a reduction in the number of nuclear weapons, or the risk of nuclear war. It will take an organized mass movement to make good on this opportunity to meaningfully reduce the risk of nuclear war."

The re-emerging ICBM controversy is yet another high-stakes example of the kind of gauntlet that disarmament advocates regularly face in official Washington, where presenting an analysis grounded in sanity is almost certain to be viewed as "not realistic." On the other hand, when it comes to nuclear issues, accommodating to "crackpot realism" is a precondition for being taken seriously by the movers and shakers on Capitol Hill and in the executive branch.

The re-emerging ICBM controversy is yet another high-stakes example of the kind of gauntlet that disarmament advocates regularly face in official Washington, where presenting an analysis grounded in sanity is almost certain to be viewed as "not realistic." On the other hand, when it comes to nuclear issues, accommodating to "crackpot realism" is a precondition for being taken seriously by the movers and shakers on

Capitol Hill and in the executive branch.

Such accommodation involves adjusting to a magnitude of systemic insanity almost beyond comprehension. Disarmament advocates are often confronted with a tacit choice between seeming unserious to the nuclear priesthood and its adherents or pushing for fairly minor adjustments in what Ellsberg, in the title of his final landmark book, dubbed all too accurately *The Doomsday Machine*. This country's anti-nuclear and disarmament groups have scant presence in the mainstream media. And the more forthright they are in directly challenging the government's nonstop nuclear recklessness—with results that could include billions of deaths from "nuclear winter"—the less media access they're apt to get. When President Biden reneged on his 2020 campaign pledge to adopt a no-first-use policy on nuclear weapons, for instance, critical blowback in the media was meager and fleeting. Little news coverage occurred when a small number of members of Congress went out of their way to object.

"Unfortunately," Markey said in a speech on the Senate floor two years ago, "our American democracy and Russia's autocracy do share one major thing in common: Both our systems give the US and Russian presidents the godlike powers known as sole authority to end life on the planet as we know it by ordering a nuclear first strike."

Nuclear Madness and Psychic Numbing: Any nuclear first strike would likely lead to a full-scale nuclear war. And the science is clear that a "nuclear winter" would indeed follow—in Ellsberg's words, "killing harvests worldwide and starving to death nearly everyone on earth. It probably wouldn't cause extinction. We're so adaptable. Maybe 1% of our current population of 7.4 billion could survive, but 98% or 99% would

not." Such a steep plunge in planetary temperatures would exceed the worst prognoses for the effects of climate change, even if in the other direction, temperature-wise. But leaders of the climate movement rarely even mention the capacity of nuclear arsenals to destroy the planet's climate in a different way from global warming. That omission reflects the ongoing triumph of nuclear madness and the "psychic numbing" that accompanies it.

During the more than three-quarters of a century since August 1945, when the U.S. government dropped atomic bombs on Hiroshima and Nagasaki, the nuclear genie has escaped from the bottle to eight other countries—Russia, France, the UK, China, Pakistan, India, Israel, and North Korea—all now brandishing their own

ultimate weapons of mass destruction. And the biggest nuclear powers have continuously undermined the NPT. Key dynamics have scarcely changed since, in 2006, the Center for International Governance Innovation published a cogent analysis that concluded: "Europe and North America are busy championing nuclear weapons as the ultimate security trump card and the preeminent emblem of political gravitas, thereby building a political/security context that is increasingly hostile to non-proliferation."

Like Obama before him, Joe Biden promised some much-needed changes in nuclear policies during his successful quest to win the White House, but once in office—as with Obama's pledges—those encouraging vows turned out to be so much smoke. The administration's long-awaited Nuclear Posture Review (NPR), issued in October 2022, was largely the usual dose of nuclear madness. "Although Joe Biden during his presidential election campaign spoke strongly in favor of adopting no-first-use and sole-purpose policies, the NPR explicitly rejects both for now," the Federation of American Scientists lamented. "From an arms control and risk reduction perspective, the NPR is a

Although Joe Biden during his presidential election campaign spoke strongly in favor of adopting no-first-use and sole-purpose policies, the NPR explicitly rejects both for now," the Federation of American Scientists lamented. "From an arms control and risk reduction perspective, the NPR is a disappointment. Previous efforts to reduce nuclear arsenals and the role that nuclear weapons play have been subdued by renewed strategic competition abroad and opposition from defense hawks at home.

disappointment. Previous efforts to reduce nuclear arsenals and the role that nuclear weapons play have been subdued by renewed strategic competition abroad and opposition from defense hawks at home.”

Stymied by the Biden administration and Congress, many organizations and activists working on nuclear-weapons issues were heartened by the blockbuster movie *Oppenheimer*, promoted from the outset as an epic thriller about “J. Robert Oppenheimer, the enigmatic man who must risk destroying the world in order to save it.” For several months before the film’s release last July, activists prepared to use it as a springboard for wider public discussion of nuclear weapons. The film did indeed make a big splash and sparked more public discussion of nukes in the US than had occurred in perhaps decades. The movie had notably stunning production values. Unfortunately, its human values were less impressive, especially since people on the receiving end of the scientific brilliance at Los Alamos in Hiroshima and Nagasaki (and even downwinders in New Mexico) remained off-screen.

Watching the movie, I thought of my visit to the Los Alamos National Laboratory about 60 years after the triumphant Trinity atomic test. During an interview, one of the public relations specialists there explained that the legal entity managing the Los Alamos lab was “a limited liability corporation.” That seemed to sum up our government’s brazen lack of accountability for the nuclearization of our planet.

Six months after *Oppenheimer* arrived at multiplexes, its political impact appears to be close to zero. The film’s disturbing aspects plowed the ground, but—in the absence of a strong disarmament movement or effective leadership among officials in Washington on nuclear weapons issues—little seeding has taken place.

At the end of January, supporters marked the first anniversary of H. Res. 77, a bill sponsored by Representative Jim McGovern of Massachusetts and cosponsored by 42 other members of the House, “embracing the goals and provisions of the Treaty on the Prohibition of Nuclear Weapons.” The nonbinding measure aptly summarizes the world’s nuclear peril and offers valuable recommendations, beginning with a call for the US to actively pursue and conclude “negotiations on a new, bilateral nuclear arms control and disarmament framework agreement with the Russian Federation” as well as purposeful talks “with China and other nuclear-armed states.”

Specific recommendations in the bill include: “renouncing the option of using nuclear weapons first; ending the President’s sole authority to launch a nuclear attack; taking the nuclear weapons of the US off hair-trigger alert; and canceling the plan to replace the nuclear arsenal of the US with modernized, enhanced weapons.”

Specific recommendations in the bill include: “renouncing the option of using nuclear weapons first; ending the President’s sole authority to launch a nuclear attack; taking the nuclear weapons of the US off hair-trigger alert; and canceling the plan to replace the nuclear arsenal of the US with

modernized, enhanced weapons.” The fact that only 10% of House members have even chosen to sponsor the resolution shows just how far we have to go to begin putting the brakes on a nuclear arms race that threatens to destroy—all too literally—everything.

Source: <https://www.commondreams.org/opinion/breaks-on-nuclear-arms-race>, 09 February 2024.

OPINION – Rafael Loss

Living in a Nuclear-Curious World: America’s Weakening Grip on Non-proliferation

Upon taking office in 2013, Chinese leader Xi Jinping set out to lay “the foundation for a future where we will [...] have the dominant position.” The country’s accelerating nuclear weapons buildup suggests that this ambition extends to the nuclear domain, and in this, Xi seems to have the support of his people. Among the 20 countries recently polled by ECFR and Oxford University, China had the most pro-nuclear population by far: eighty-six per cent said they support their country having

access to nuclear weapons.

It is not the only data point that should worry Western policymakers. Majorities in Saudi Arabia and South Korea, as well as a plurality of Turkish citizens, also support their countries having access to nuclear weapons. The first is a close security partner of the United States, the latter two formal allies which the US is treaty-bound to defend. None command a nuclear arsenal of their own, but if their leaders determined that changes in the security environment necessitated a nuclear deterrent, their populations would likely go along. Likely Republican presidential nominee Donald Trump's recent comments encouraging adversaries to attack "delinquent" US allies only adds fuel to such concerns.

Majorities in Saudi Arabia and South Korea, as well as a plurality of Turkish citizens, also support their countries having access to nuclear weapons. The first is a close security partner of the United States, the latter two formal allies which the US is treaty-bound to defend. None command a nuclear arsenal of their own, but if their leaders determined that changes in the security environment necessitated a nuclear deterrent, their populations would likely go along. Likely Republican presidential nominee Donald Trump's recent comments encouraging adversaries to attack "delinquent" US allies only adds fuel to such concerns.

Since the dawn of the cold war, US security guarantees are designed to give allies confidence that they remain secure without acquiring nuclear weapons themselves. The arrangements ultimately rest on America's nuclear arsenal and the promise – in the worst of cases – to employ it on their behalf. So far, the Biden administration has opted for "a 'better' approach – not a 'more' approach" to assure allies and maintain deterrence, emphasising non-nuclear capabilities and intensified coordination over expanding its nuclear arsenal.

Wary that Russia or China could exploit their growing superiority in regional nuclear capabilities over the US-led alliances in Europe and Asia, the panel recommended developing and adding new systems to the current setup of US non-strategic nuclear forces. Although any such decision would take some time to implement, making it now would signal resolve.

The Congressional Commission on the Strategic Posture of the United States posits that this approach may not suffice for much longer. The bipartisan panel, including progressive Democrats

and former Trump administration officials, sees a growing risk of concurrent – be it opportunistic or coordinated – military conflict with China and Russia. Alongside China's development of intercontinental missiles, the panel observed the country's buildup of shorter-range nuclear missiles, as well as Russia's continuing expansion of its already-vast nuclear arsenal designed for regional use. Wary that Russia or China could exploit their growing superiority in regional nuclear capabilities over the US-led alliances in Europe and Asia, the panel recommended developing and adding new systems to the current setup of US non-strategic nuclear forces.

Although any such decision would take some time to implement, making it now would signal resolve.

In Europe, this would require leaders to take a hard look at NATO's nuclear sharing arrangements. In 2012, the alliance declared that its "nuclear force posture currently meets the criteria" for effective deterrence and defence. Two years later, Russia annexed Crimea, and in 2022, it followed with its full-scale invasion of Ukraine. In between, Moscow violated the INF treaty by deploying a non-compliant ground-launched cruise missile capable of hitting targets across Europe. NATO's nuclear capability, meanwhile, has largely remained the same since the 1990s: if called upon, allied fighter jets would carry US nuclear bombs deployed at airbases in Belgium, Germany, the Netherlands, and Italy.

NATO's stance sits most uneasily with central and eastern European allies. According to ECFR polling, societies that are most concerned about a Russian military attack are least opposed to having access to nuclear weapons. With their public's apparent backing, Polish leaders have been most vocal in expressing their desire to be included in the club of countries contributing jets to NATO's nuclear mission and hosting US nuclear weapons. Poland's and other NATO countries' purchases of F-35 stealth aircraft, which the four current host countries plan to use for their nuclear sharing role, could facilitate such an expansion. There are also calls to develop and deploy new nuclear weapons, such as stand-off cruise missiles or ground-launched systems. As West Germany's need for nuclear assurance was a major driver for the continuous adaptation of NATO's nuclear posture throughout the cold war, Berlin should be particularly empathetic to similar voices from today's frontline allies.

However, discussing adaptations to NATO's nuclear posture assumes there is a posture to adapt – without US extended deterrence this is hardly the case. Germany's former foreign minister Joschka Fischer and others have begun to think out loud about the possible return of Donald Trump to the White House and its nuclear implications. Trump questioning America's commitment to its allies would leave Europeans with no good options. A US withdrawal from NATO would only add more bad ones. National nuclear weapons programmes seem a remote possibility. But if the non-proliferation regime were to crumble under unpunished Russian nuclear use in Ukraine,

for example, governments the world over might conclude that it no longer serves their security interests and instead reach for the bomb themselves.

Source: <https://ecfr.eu/article/living-in-a-nuclear-curious-world-americas-weakening-grip-on-non-proliferation/>, 13 February 2024.

OPINION – David Appleyard

Pulling the Levers on Nuclear Build Out

Trump questioning America's commitment to its allies would leave Europeans with no good options. A US withdrawal from NATO would only add more bad ones. National nuclear weapons programmes seem a remote possibility. But if the non-proliferation regime were to crumble under unpunished Russian nuclear use in Ukraine, for example, governments the world over might conclude that it no longer serves their security interests and instead reach for the bomb themselves.

If nuclear is to build on its current momentum multiple levers must be pulled by the state, regulators, and the industry. Key to that promise is delivering capacity on time and on budget. Can nuclear achieve the ultimate goal?

In the wake of COP28, the recent World Economic Forum (WEF) further emphasised the importance of nuclear energy in the future energy mix. The Forum outlined multiple

compelling reasons for nuclear energy to be included. Noting the 20,000 reactor years of experience across the world, the Forum stated that nuclear energy has the lowest carbon footprint

and needs fewer materials and less land than any other electricity source. Helpfully, they also agree that nuclear is one of the safest forms of generation – they indicate nuclear is about as safe as solar and much safer than coal, gas and oil and almost every

other energy source currently available. The organisation also points to the abundance of uranium in the earth's crust and oceans, the fact that it doesn't rely on the weather, and the relatively small amount of nuclear waste that is produced. WEF suggests that all spent nuclear fuel ever produced would, in theory, fit into just 42 Olympic-sized swimming pools, for example.

If nuclear is to build on its current momentum multiple levers must be pulled by the state, regulators, and the industry. Key to that promise is delivering capacity on time and on budget. Can nuclear achieve the ultimate goal.

Given nuclear is the cleanest, least environmentally burdensome and ultimately lowest cost form of generation, considering the lifetime of a nuclear plant, then why aren't they being built every week? Certainly, high profile accidents like Chernobyl and Fukushima Daiichi remain a painful reminder of when things go badly wrong but perhaps more pertinent is the industry still struggling to shed its image. It's an image that is apparently indelibly associated with cost and delivery overruns. The recent EDF announcement regarding the likelihood of further cost overruns and slipping schedules are a case in point.

Despite this, WEF is adamant that three main levers can be pulled in order to triple current investment levels and build the nuclear capacity needed to meet net zero targets. Perhaps most fundamentally, WEF argues that nuclear must be acknowledged for what it does deliver as a reliable, scalable, safe and affordable low-carbon source of energy. Doing so will allow the technology to be treated fairly with respect to investment incentives, they say. Nuclear certainly needs to attract private investment but given the high capital cost risk during the construction phases, there are evidently too much of a challenge for the private sector alone. WEF is calling for governments to help shoulder that burden. Similarly, they recommend providing guaranteed revenues and changing the policies preventing nuclear energy investment by many international financial institutions and development banks. The WEF also turns to regulators, calling for the relevant authorities to build internal capacity able to license new reactor designs more quickly. At the same time, industry has to play its part by stepping up and delivering projects on time and on budget.

Given nuclear is the cleanest, least environmentally burdensome and ultimately lowest cost form of generation, considering the lifetime of a nuclear plant, then why aren't they being built every week? Certainly, high profile accidents like Chernobyl and Fukushima Daiichi remain a painful reminder of when things go badly wrong but perhaps more pertinent is the industry still struggling to shed its image.

UK must connect 15.5 GW of new zero-carbon generating capacity each year to 2035 to meet these system goals. In contrast, just 4.5 GW was connected to the UK national grid in 2022.

Putting these necessary actions in context, AtkinsRealis recently published new forecasts of the required annual build rate of new generation to meet UK net zero targets. They conclude that 187 GW of new generating capacity is required for the country to replace ageing power plants and meet the increasing demand associated with greater electrification of transport and industry. Their new analysis predicts that the UK must

connect 15.5 GW of new zero-carbon generating capacity each year to 2035 to meet these system goals. In contrast, just 4.5 GW was connected to the UK national grid in 2022. What stands out from this report is that annual new build targets jump every year as every moment of delay loads the rear end, a development that will ultimately make the end goal all but impossible to

reach. It's clear then that for nuclear to play its part will take stupendous effort across multiple areas of both state and the private enterprise sectors. Can nuclear rise to the challenge? The World Economic Forum seems to think so, but part of that task is to ensure that the truth of what nuclear does do well gets out. At the same time, for nuclear to be taken seriously as a key component of the clean energy toolbox, the industry has to make sure that it does everything else better.

Source: <https://www.neimagazine.com/opinion/opinionpulling-the-levers-on-nuclear-build-out-11501621/>, 08 February 2024.

NUCLEAR STRATEGY

RUSSIA

Putin Says Russia's New Sarmat Nuclear Missiles Soon Ready for Deployment

President Putin said that Russia's new generation of Sarmat intercontinental ballistic missiles, which

are capable of carrying 10 or more nuclear warheads, would soon be deployed for combat duty. In a speech to new graduates of military academies, Putin stressed the importance of Russia's "triad" of nuclear forces that can be launched from land, sea or air. The first Sarmat launchers will be put on combat duty "in the near future", Putin said. Defence Minister Shoigu told the assembled graduates in the Kremlin's St George's Hall, which commemorates the greatest feats in Russian military history, that the "collective West" was waging a "real war" against Russia.

Putin has repeatedly said since the start of the Ukraine conflict that Russia is ready to use all means, including nuclear weapons, to defend its "territorial integrity". Last year he said he was placing territories seized in Ukraine that Russia now claims as its own under Moscow's nuclear umbrella. The new Sarmat missile is designed to carry out nuclear strikes on targets thousands of missiles away in the USA or Europe. But its deployment has proceeded slower than planned, as Russia had said in April 2022 that it would be in place by autumn of that year.

Source: <https://www.reuters.com/business/aerospace-defense/putin-says-russias-new-sarmat-nuclear-missiles-soon-ready-deployment-2023-06-21/>, 21 June 2023.

SOUTH KOREA

South Korean President Reiterates that Seoul will not Seek its Own Nuclear Deterrent

South Korea's President Yeol reiterated that the country would not seek its own nuclear deterrent in the face of threats from nuclear-armed North Korea as he vowed further efforts to sharpen nuclear deterrence strategies with ally US. In a pre-recorded interview with KBS television that aired, Yoon insisted that South Korea clearly

The new Sarmat missile is designed to carry out nuclear strikes on targets thousands of missiles away in the USA or Europe. But its deployment has proceeded slower than planned, as Russia had said in April 2022 that it would be in place by autumn of that year.

has the technology to quickly acquire nuclear weapons capabilities if it ever decides to do so.

But taking that step isn't a realistic option as it would ruin a trade-dependent economy, he said. "If we develop nuclear weapons, we will receive various economic sanctions like North Korea does now, and our economy will be dealt a serious blow," Yoon said,

while emphasizing Seoul's commitment to the nuclear Nonproliferation Treaty. Yoon, a conservative who took office in 2022, has made similar comments before as he pushed for stronger reassurances from Washington that it would swiftly and decisively use its nuclear capabilities to defend its ally in the event of a North Korean nuclear attack.

Source: <https://apnews.com/article/south-korea-yoon-suk-yeol-nuclear-north-korea-35f002effe08a320580eb38e5a2a727b>, 08 February 2024.

NUCLEAR ENERGY

BULGARIA

Bulgaria's Two US Nuclear Reactors to Cost Under \$14 Billion

Bulgaria is insisting on a fixed price for the construction of two new Westinghouse AR-1000 nuclear reactors, which should not exceed \$14 billion, according to an intergovernmental agreement on nuclear cooperation between Bulgaria and the US signed in Sofia on Monday night.

The new reactors will be built on the banks of the Danube, where the Kozloduy nuclear power plant is located. They will operate in parallel with the two Russian reactors until 2050. After 2050, the old Russian reactors will be decommissioned.

...Bulgarian Energy Minister Rumen Radev commented that the government wants to sign

the contract for the construction of the new nuclear facilities at a fixed price, which should not exceed \$14 billion. This is the biggest investment in the last 50 years for Bulgaria, which is expected to reach a GDP of just over €100 billion this year. Until ten years ago, Bulgaria was planning to build a nuclear power station with two new Russian nuclear reactors delivered five years ago by Russia's Atomstroyexport, but the war in Ukraine changed everything. Now the plan is to sell the Russian reactors to Ukraine, which is considering paying for them with EU aid.

The agreement between Bulgaria and the US covers cooperation in the installation of small modular reactors in industry, decommissioning of reactors, processing and storage of spent nuclear fuel, joint nuclear research and exchange of personnel.

Radev says that the new VII block of the Kozloduy NPP should enter into operation at the end of 2034. Light commented that the benefits of building two new nuclear units far outweighed the billion-dollar investment. He added that it is about opening a huge number of new jobs and the development of Bulgarian experience in nuclear technologies, which will make the country a leader in the region.

The price of electricity produced by the new reactors will be around €65/MWh which has led to criticism as the price is much higher than that of electricity from renewable sources. The Bulgarian government claims that the country cannot be left without baseload electricity after the Russian nuclear units are shut down. On 2 February, the director of the NPP, Valentin Nikolov, announced that so far five companies had unofficially expressed interest in building the new reactors. Of these, only one is European – Elektristi de France. The others are the US company Bechtel, with which Westinghouse is working on the AP-1000 projects in Poland and the Czech Republic, and Korea's Hyundai, with

which Westinghouse is also working. The others are China's CNNC and the US company Fluor, which owns NewScale, a company developing small modular reactors.

In an interview with Euractiv Bulgaria in October, Prime Minister Nikolai Denkov said that Greece, Serbia and Northern Macedonia were interested in concluding long-term contracts for the purchase of electricity from the future units VII and VIII of the Kozloduy nuclear power plant. Asked whether

it would be possible to obtain European funding for the construction of the new facilities, Denkov said that this was not a major issue as the project was "quite promising" for the state from an economic point of view. He explained that Bulgaria will use the two new reactors as the base

capacity of the energy system during the gradual phasing out of coal.

Source: Krassen Nikolov, <https://www.euractiv.com/section/politics/news/bulgarias-two-us-nuclear-reactors-to-cost-under-14-billion/>, 14 February 2024.

BRAZIL

CNEN and Eletronuclear Discuss Brazilian Nuclear Programme

The presidents of the National Nuclear Energy Commission (CNEN), Rondinelli, and Eletronuclear, Leite, covered Angra 3's prospects for 2029 completion, domestic fuel supply, the Brazilian Multipurpose Reactor and site selection for the radioactive waste-focused Nuclear Technology Centre (CENTENA) in their talks.

Rondinelli said the meeting "represents Brazil". He gave an update on the negotiations relating to CENTENA which will be a disposal facility for radioactive waste, with operational support buildings and research and technological facilities for things such as nuclear medicine. Leite said that the supply of nuclear fuel "adding term". They agreed on the need for a fresh Brazilian nuclear

The presidents of the National Nuclear Energy Commission (CNEN), Rondinelli, and Eletronuclear, Leite, covered Angra 3's prospects for 2029 completion, domestic fuel supply, the Brazilian Multipurpose Reactor and site selection for the radioactive waste-focused Nuclear Technology Centre (CENTENA) in their talks.

programme, with Rondinelli indicating the process of developing it would be outlined after June's 5th National Conference on Science, Technology and Innovation. Their meeting came a week after representatives from Eletronuclear and Empresa Brasileira de Participações em Energia Nuclear e Binacional (ENBpar) met with regional government figures to discuss strategic projects for the company, including the life extension project for Angra 1 as well as completion of Angra 3.

Source: <https://www.world-nuclear-news.org/Articles/CNEN-and-Eletronuclear-discuss-Brazilian-nuclear-p>, 09 February 2024.

CHINA

Outer Dome Installed at China's ACP100 SMR

China National Nuclear Corporation (CNNC) said the outer containment dome has been installed at the ACP-100 SMR demonstration project at the Changjiang NPP in Hainan Province. The multi-purpose 125 MWe SMR (also known as Linglong One) is a pressurised water reactor designed for electricity generation, urban heating, urban cooling, industrial steam production, or seawater desalination. The reactor building for the ACP100 consists of three parts: the internal structure, the steel containment shell and the outer concrete shielding shell. The inner steel containment dome was installed in November.

According to CNNC, lifting and installing the 550-tonne outer shell took one hour and thirty-eight minutes. The main structure of the reactor building has now been completed paving the way for the subsequent capping of the reactor building. Weimin, deputy director of the Hainan Nuclear Power Engineering Management Office explained. He added that this represented

The multi-purpose 125 MWe SMR (also known as Linglong One) is a pressurised water reactor designed for electricity generation, urban heating, urban cooling, industrial steam production, or seawater desalination. The reactor building for the ACP100 consists of three parts: the internal structure, the steel containment shell and the outer concrete shielding shell.

valuable experience for subsequent modular development of new nuclear. The installation was completed in time for Chinese New Year and the Spring Festival holidays. CNNC said the 6,000 workers at the project site will stay at their jobs "and go all out to ensure that the project is completed on time". The project involves owner-operator CNNC subsidiary China National Nuclear Power, reactor designer Nuclear Power Institute of China and China Nuclear Power Engineering Group responsible for plant construction. The reactor vessel is being supplied by Shanghai Boiler Works Limited, the steam generators by another CNNC subsidiary and other reactor internals by Dongfang Electric Corporation....

Source: <https://www.neimagazine.com/news/newsouter-dome-installed-at-chinas-acp100-smr-11501234>, 08 February 2024.

HUNGARY

Paks II Progressing as Planned

Work on the expansion of the Paks NPP (Paks II) is proceeding smoothly, which will enable Hungary to maintain its energy security, preserve the results of the reduction of electricity prices, and further strengthen environmental protection, said Minister of Foreign Affairs & Trade Szijjártó. He noted that he had reviewed the status of the Paks expansion project in a recent telephone conversation with Rosatom DG Likhachev, to ensure that the project can be handed over as soon as possible. Likhachev will be visiting Hungary again soon to review the status of the process and the legal issues involved.

The Paks II project was launched in 2014 by an inter-governmental agreement between Hungary and Russia for two VVER-1200 reactors (units 5&6)

Work on the expansion of the Paks NPP (Paks II) is proceeding smoothly, which will enable Hungary to maintain its energy security, preserve the results of the reduction of electricity prices, and further strengthen environmental protection.

to be supplied by Rosatom. The contract was supported by a Russian state loan to finance the majority of the project. The Hungarian Atomic Energy Authority issued the licence for the units in August 2022. The following December, the Hungarian parliament approved the extension of the life of the four existing VVER-440 power units at the Paks NPP for another 20 years. The current life of the station's nuclear reactors would have ended in 2032-2037, and now it is assumed that they will work until at least 2052-2057. Paks currently provides half of all generated and one third of the consumed electricity in Hungary.

Source: <https://www.neimagazine.com/news/newspaks-ii-progressing-as-planned-11502004>, 09 February 2024.

INDIA

Pressure Vessel in Place at Indian Plant

The reactor vessel for Kudankulam unit 4 has been lifted into its design position at the construction site in Tamil Nadu, Rosatom announced. The company said the installation was carried out on 24 January using the "open top" method, first used at Kudankulam 3. This involves installing the component while the reactor dome is still open, which can significantly cut the time taken to carry out the installation. On the day of the installation, the equipment was moved to a vertical position, then lifted by crane to a height of 50 mts and lowered into the reactor shaft of the reactor building. The pressure vessel, weighing in at over 317 t, was delivered from Volgodonsk in Russia to the Kudankulam construction site in 2023 as part of an "unprecedentedly complex and large-scale" simultaneous shipment of two reactor

The reactor vessel for Kudankulam unit 4 has been lifted into its design position at the construction site in Tamil Nadu, Rosatom announced. The company said the installation was carried out on 24 January using the "open top" method, first used at Kudankulam 3. This involves installing the component while the reactor dome is still open, which can significantly cut the time taken to carry out the installation.

The INTC already has three operating small reactors which are used for research and training: a light water sub-critical assembly, which began operation in 1992; a 30 MWt light water miniaturised neutron source reactor, which began operation in 1994; and a heavy water zero power reactor that began operation in 1995.

vessels and eight steam generators for plants under construction in India and China, according to Rosatom.

Source: <https://www.world-nuclear-news.org/Articles/Pressure-vessel-in-place-at-Indian-plant>, 05 February 2024.

IRAN

First Concrete Poured for New Iranian Research Reactor

First concrete has been poured for a new multi-purpose 10 MW research reactor at the Isfahan Nuclear Technology Centre (INTC). The head of Atomic Energy Organisation of Iran (AEOI), Eslami, attending the launch ceremony, said that the process of designing and constructing reactors requires detailed studies, preparation, and equipment designs, adding that plans for the new reactor had started last year. He added that the reactor is being constructed to provide a powerful neutron source with high neutron flux. It will be used for fuel and materials testing as well as for the production of industrial radioisotopes and radiopharmaceuticals.

The INTC already has three operating small reactors which are used for research and training: a light water sub-critical assembly, which began operation in 1992; a 30 MWt light water miniaturised neutron source reactor, which began operation in 1994; and a heavy water zero power reactor that began operation in 1995. Another graphite sub-critical reactor has been decommissioned. INTC also has a conversion facility, a fuel production plant, a zirconium cladding plant, and other facilities and laboratories. This comes a few days after Iran announced the start of construction of a new

5,000 MWe NPP at Sirik in the southern coastal province of Hormozgan.

Source: <https://www.neimagazine.com/news/newsfirst-concrete-poured-for-new-iranian-research-reactor-11501346>, 08 February 2024.

RUSSIA

Second RBMK Unit Closed at Russia's Kursk NPP

The RBMK reactor at unit 2 of Russia's Kursk NPP has been permanently shut down after 45 years of operation. Kursk NPP comprises four ageing RBMK-1000 units, two of which are now closed down. The plant will be replaced by the Kursk-II plant being built on an adjacent site which will have VVER-TOI reactors. Units 1&2 are currently under construction.

During its operating life, Kursk 2 generated more than 256 TWh of electricity. ...Unit 1 at Kursk-II should begin operation later this year. The design life of the RBMK-1000 reactors at Kursk NPP was initially 30 years, but after extensive technical modernisation, the service life of all four units was extended for another 15 years.

Meanwhile, Rosatom has completed the installation of the turbine unit for the VVER-TOI reactor at Kursk-II unit 1. This operation was completed with the installation of the turbine shaft line. Installation was preceded by a lot of preparatory work: exhibiting bearing cases, centring rotors by half couplings, displaying cylinders relative to rotors, etc. the work then underwent a quality check. Work will now start on the third (final) stage of concreting – the grading of the foundation frames and wells of the turbine and generator.

Rosatom has completed the installation of the turbine unit for the VVER-TOI reactor at Kursk-II unit 1. This operation was completed with the installation of the turbine shaft line. Installation was preceded by a lot of preparatory work: exhibiting bearing cases, centring rotors by half couplings, displaying cylinders relative to rotors, etc. the work then underwent a quality check. Work will now start on the third (final) stage of concreting – the grading of the foundation frames and wells of the turbine and generator.

High fusion power was consistently produced for 5 seconds during JET's final deuterium-tritium experiments resulting in a ground-breaking record of 69 MJ, using only 0.2 mgs of fuel, the EUROfusion consortium and UK Atomic Energy Authority (UKAEA) announced.

Source: <https://www.neimagazine.com/news/newssecond-rbmk-unit-closed-at-russias-kursk-npp-11481279>, 01 February 2024.

UK

New World Record Set in JET's Final Fusion Experiments

High fusion power was consistently produced for 5 seconds during JET's final deuterium-tritium experiments resulting in a ground-breaking record of 69 MJ, using only 0.2 mgs of fuel, the EUROfusion consortium and UK Atomic Energy Authority (UKAEA) announced. This exceeded the previous world record it set in 2021, when it produced 59 MJ over 5 seconds.

The tokamak's final experiments using deuterium and tritium fuel were conducted over seven weeks from August to October last year, ahead of its retirement following its final pulse in December. JET, which is in Culham, near Oxford in the UK, was a European project built and used collaboratively by European researchers. It is now owned, and in

recent years has been operated by, the UKAEA, and used by scientists from 28 European countries to conduct research into the potential for carbon-free fusion energy in the future through work coordinated by the EUROfusion consortium. The tokamak's first deuterium-tritium experiments took place in 1997. JET was a tokamak fusion system with a doughnut-shaped vacuum chamber where, under the influence of extreme heat and pressure, gaseous hydrogen fuel becomes a plasma. The charged particles of the plasma can be shaped and controlled by massive magnetic coils placed

around the vessel to confine the hot plasma away from the vessel walls. It was the only tokamak fusion machine in operation capable of handling tritium fuel, and was a key device in preparations for the multinational ITER fusion research project which is currently under construction in southern France.

Source: <https://www.world-nuclear-news.org/Articles/New-world-record-set-in-JET-s-final-fusion-experim>, 09 February 2024.

MoltexFLEX Publishes New Graphite Research

Scientists at UK-based MoltexFLEX have published new research on how graphite interacts with the molten salt to be used in the company's FLEX reactor design. Together with scientists at the University of Manchester's Nuclear Graphite Research Group (NGRG), the researchers used x-ray micro CT scanners to investigate how tiny amounts of molten salt infiltrated pores within standard industrial grades of graphite. This was the first time such scanning has been used for this purpose. MoltexFLEX has been working with the NGRG on graphite-related research for more than three years.

The NGRG team, led by Professor Jones, is internationally recognised for its particular expertise in graphite research. MoltexFLEX said in September 2023 that it had "reached a watershed in the development of its small modular FLEX reactor" and would move from the pre-concept science phase into accelerated product and project delivery. Moltex Energy launched its MoltexFLEX subsidiary in 2022 specifically to work on the FLEX reactor – the

Scientists at UK-based MoltexFLEX have published new research on how graphite interacts with the molten salt to be used in the company's FLEX reactor design. Together with scientists at the University of Manchester's Nuclear Graphite Research Group (NGRG), the researchers used x-ray micro CT scanners to investigate how tiny amounts of molten salt infiltrated pores within standard industrial grades of graphite. This was the first time such scanning has been used for this purpose.

MARVEL - a sodium-potassium-cooled microreactor designed to generate 85 KW of thermal energy - is to be built inside the Transient Reactor Test Facility at Idaho National Laboratory where it will be used to advance new reactor technologies.

latest application of the company's stable salt reactor (SSR) design. This is the thermal spectrum version of Moltex Energy's SSR technology, which uses graphite as the moderator. That technology is shared with MoltexFLEX's sister company, Moltex Energy Canada, which is developing a fast spectrum version (the SSR-W).

Source: <https://www.neimagazine.com/news/newsmoltexflex-publishes-new-graphite-research-11502011>, 09 February 2024.

USA

TRIGA International Begins Fabricating MARVEL Fuel

The Framatome-General Atomics joint venture has begun fabricating the fuel for the US DOE MARVEL microreactor, with delivery of the first shipment of fuel expected in spring 2025. MARVEL - a sodium-potassium-cooled microreactor designed to generate 85 KW of thermal energy - is to be built inside the Transient Reactor Test Facility at Idaho National Laboratory where it will be used to advance new reactor technologies. It will be one of the first new reactors to be built at the lab in more than four decades, and is expected to be online in 2027, with future plans to connect it to a microgrid. The fuel the reactor will use is similar to the uranium-zirconium hydride fuel used in the TRIGA pool-type research reactors that are in operation at various universities around the world. TRIGA International is the only supplier of fuel for those reactors.

TRIGA International was awarded a contract worth about USD 8.4 M late last year to produce 37 fuel elements for the MARVEL project. It started the fabrication process at its facility in Romans,

France, late last month, the DOE said. A preliminary safety analysis report for MARVEL will be submitted for review later this year as part of the DOE authorisation process, and tests are also underway on a full-scale, non-electric prototype of the reactor - the primary coolant apparatus test, or PCAT - to provide data on the system's coolant flow and power generation to ensure the reactor will perform as expected. PCAT has been installed at Creative Engineers Inc's manufacturing facility in Pennsylvania.

Source: <https://www.world-nuclear-news.org/Articles/TRIGA-International-begins-fabricating-MARVEL-fuel>, 08 February 2024.

Holtec Unveils Combined Nuclear-Solar Power Plant Design

US-based Holtec International has announced a combined nuclear-solar power plant design - CNSP (Combined Nuclear/Solar Plant). It combines Holtec's SMR-300 SMR design with its HI-THERM HSP, solar thermal system as well as its Green Boiler to provide base load or on-demand power to counter the intermittency of solar plants. The Green Boiler is a three-in-one device that can store vast amounts of heat, receives high temperature heat from the solar collector, and make motive steam at the required pressure and superheat to power the turbine. ...

Holtec says the most immediate application of the CNSP technology is to facilitate the transition from "coal to clean". Coal-fired plants typically have sufficient land area to house the CNSP, which would use the coal plant's power block minimising the cost of transition. The steam production part of the coal plant will be decommissioned, freeing up most of the plant's land area for the solar plant.

It combines Holtec's SMR-300 SMR design with its HI-THERM HSP, solar thermal system as well as its Green Boiler to provide base load or on-demand power to counter the intermittency of solar plants. The Green Boiler is a three-in-one device that can store vast amounts of heat, receives high temperature heat from the solar collector, and make motive steam at the required pressure and superheat to power the turbine.

Holtec plans to offer the CNSP technology principally in those regions of the world where solar radiation level is adequate to be harvestable.

Solar's contribution to the CNSP will be through the HI-THERM HSP hybrid solar plant, "which is considerably more efficient than its predecessor technologies, yielding as much as 8 MWH of solar heat per acre in equatorial and subtropical locales". The nuclear

reactor's steam supply system and heat from the solar thermal plant "are conjugated in the Green Boiler which is a multi-function device engineered to produce steam at the desired pressure and superheat to run the coal plant's

existing turbogenerator". At sites with no pre-existing fossil plant, the solar thermal plant can be as large as the available land area will accommodate. Holtec says experts in power plant cycle design would appreciate that the CNSP will have a much

higher thermodynamic efficiency than the nuclear plant alone and would make solar power an integral part of base load supply.

Source: <https://www.neimagazine.com/news/newsholtec-unveils-combined-nuclear-solar-power-plant-design-11493133>, 06 February 2024.

SMALL MODULAR REACTORS

EU

European SMR Industrial Alliance Launched

The European Commission has launched an Industrial Alliance dedicated to SMRs, aiming to facilitate the development of SMRs in Europe by the early 2030s. The announcement came as the commission presented its assessment for a 2040 climate target for the EU.

The European Commission set up a European SMR pre-Partnership in June last year with the overall objective of identifying enabling conditions and constraints, including financial ones, towards safe design, construction and operation of SMRs in Europe in the next decade and beyond, in compliance with the EU legislative framework in general and to the Euratom legislative framework in particular. In early November, it announced that it would establish an Industrial Alliance for SMRs early this year. Industrial alliances are a tool to facilitate stronger cooperation and joint action between all interested partners. Industrial alliances can play a role in achieving key EU policy objectives through joint action by all the interested partners.

The announcement of the launch of the Industrial Alliance for SMRs came as the Commission published a detailed impact assessment on possible pathways to reach the agreed goal of making the EU climate neutral by 2050. The EU's 2030 climate target is to reduce net greenhouse gas emissions by at least 55% relative to 1990. Based on the latest impact assessment, the European Commission recommends a 90% net greenhouse gas emissions reduction by 2040 compared with 1990 levels, launching a discussion with all stakeholders; a legislative proposal will be made by the next Commission, after the European elections, and agreed with the European Parliament and Member States as required under the EU Climate Law.

Source: <https://www.world-nuclear-news.org/Articles/European-SMR-Industrial-Alliance-launched>, 07 February 2024.

POLAND

Environmental Permitting of Polish SMR Plant Progresses

Poland's General Director for Environmental Protection (GDOS - Generalna Dyrekcja Ochrony Środowiska) has issued a provision specifying the requirements for the scope of the environmental

report for construction of a SMR in Monowski Ponds in Lesser Poland. Orlen Synthos Green Energy (OSGE) can now begin environmental and siting research for its planned SMR project involving GE Hitachi Nuclear Energy's BWRX-300, for which it holds exclusive rights in Poland. In 2023, OSGE shortlisted seven locations for further geological surveys to host SMR plants – Ostrołęka, Włocławek, Stawy Monowskie, Dąbrowa Górnicza, Nowa Huta, Tarnobrzeg Special Economic Zone and Warsaw. It subsequently applied to the Ministry of Climate & Environment for decisions-

in-principle to construct plants at six locations, omitting Warsaw.

The ministry issued decisions-in-principle for the plants in December, opening the way for OSGE to apply for a number of further administrative arrangements on siting and construction. OSGE applied to GDOS in May 2023 to determine the scope of the

report on the environmental impact of the construction for the Stawy Monowskie plant. It has also submitted applications for the planned plants in Ostrołęka and Włocławek. The issue of the order by GDOS enables the OSGE to start environmental and location research at the Stawy Monowskie site to prepare an Environmental Impact Assessment Report. This is estimated to take up to two years.

GDOS has indicated the main areas that the report will cover, including: conducting a natural inventory, identifying possible sources of cooling water, technological solutions that affect nuclear safety and radiological protection, and indicating how the power plant will be integrated with the energy transmission network.

The BWRX-300 is a 300 MWe water-cooled, natural circulation SMR with passive safety systems that leverages the design and licensing basis of GEH's ESBWR which has US Nuclear Regulatory Commission certification. As a result of design simplification, GEH claims the BWRX-300 will require significantly less capital cost per MW compared with other SMR designs. GEH says the BWRX-300 is being designed to reduce

The BWRX-300 is a 300 MWe water-cooled, natural circulation SMR with passive safety systems that leverages the design and licensing basis of GEH's ESBWR which has US Nuclear Regulatory Commission certification. As a result of design simplification, GEH claims the BWRX-300 will require significantly less capital cost per MW compared with other SMR designs.

construction and operating costs below other nuclear power generation technologies. It will leverage a combination of existing fuel, plant simplifications, proven components as well as a design based on an already licensed reactor.

Source: <https://www.neimagazine.com/news/newsevironmental-permitting-of-polish-smr-plant-progresses-11494199>, 06 February 2024.

PUERTO RICO

SMRs Economically Feasible in Puerto Rico, Study Finds

The Caribbean island of Puerto Rico is favourably positioned for the introduction of advanced micro and small modular reactors, according to an economic study conducted by Puerto Rican-led not-for-profit organisation the Nuclear Alternative Project (NAP). Puerto Rico - officially, Commonwealth of Puerto Rico - is an unincorporated territory of the USA and is located in the northeastern Caribbean. Puerto Rico currently generates 98% of its electricity from imported fossil fuels, and its power plants, built in the late 1960s, experience outage rates 12 times higher than the US average. Within the next decade, Puerto Rico proposes a transition from a centralised system dependent on fossil fuels to a distributed system centred on clean energy. Its legislature in 2018 passed a bill calling for an investigation into the possibility of building NPPs on the island, which suffered widespread outages following Hurricane Maria in 2017.

NAP was founded in 2016 by Puerto Rican engineers in the US nuclear industry to inform and advocate for SMRs and microreactors in Puerto Rico. A preliminary feasibility study published by NAP in May 2020 concluded that advanced nuclear reactors can meet Puerto Rico's unique energy

The Caribbean island of Puerto Rico is favourably positioned for the introduction of advanced micro and small modular reactors, according to an economic study conducted by Puerto Rican-led not-for-profit organisation the Nuclear Alternative Project (NAP).

needs by complementing renewable sources with zero-emission electricity resilient to extreme natural events. The study was funded by the US DOE. In Nov 2021, DOE awarded USD1.6 m in funding to NAP to study the potential siting of small reactors in Puerto Rico. NAP has identified two potential sites on the island, based on US Nuclear Regulatory Commission criteria.

Source: <https://www.world-nuclear-news.org/Articles/SMRs-economically-feasible-in-Puerto-Rico,-study-f>, 08 February 2024.

SOUTH KOREA

Korean Shipbuilder Joins Nuclear Shipping Project

HD Korea Shipbuilding & Offshore Engineering (KSOE), a subsidiary of South Korea's HD Hyundai, is to collaborate in a nuclear shipping project with UK start-up Core Power and US Southern Company and TerraPower. This followed a joint research and technology exchange meeting at Terrapower's headquarters in Washington DC.

HD Korea Shipbuilding & Offshore Engineering (KSOE), a subsidiary of South Korea's HD Hyundai, is to collaborate in a nuclear shipping project with UK start-up Core Power and US Southern Company and TerraPower. This followed a joint research and technology exchange meeting at Terrapower's headquarters in Washington DC.

The project will be based on TerraPower's Molten Chloride Fast Reactor (MCFR) design, which uses molten chloride salt as both reactor coolant and fuel, which enables fast spectrum operation at higher temperatures than conventional reactors, generating electricity more efficiently. It also offers potential for process heat applications and thermal storage. A version of the MCFR – the m-MSR – is being developed for marine use. In Oct 2023, Southern Company, TerraPower and Core Power began pumped-salt operations in the Terrapower's Integrated Effects Test (IET), as a step towards development of the MCFR. The project was initiated by Southern Company and TerraPower under the US DOE Advanced Reactor Concepts (ARC-15) award, a multi-year effort to promote the design,

construction and operation of Generation-IV nuclear reactors. ARC-15 involves a total project investment of \$76m based on a 60-40% public-private cost share.

Source: <https://www.neimagazine.com/news/newskorean-shipbuilder-joins-nuclear-shipping-project-11502161>, 09 February 2024.

UK

Agreement Signed for Planned UK Fleet of AP300 Reactors

Westinghouse has signed an agreement with Community Nuclear Power Limited (CNP) for the construction of four AP300 SMRs in the North Teesside region of northeast England. It would be the UK's first privately-financed SMR fleet. CNP - formed in September 2022 - is working with strategic partners, including Jacobs and Interpath Advisory, to develop a fully licensed site for the project, with a target of 2027. The project is being privately funded.

The project is in accordance with the recently published UK Government Alternative Routes to Market for New Nuclear Projects consultation and complementary to and supportive of

Westinghouse's participation in Great British Nuclear's (GBN's) SMR technology selection process, Westinghouse noted. The UK government has plans to expand nuclear energy capacity to 24 GW by 2050, with a fleet of SMRs a key part of that strategy. Last year, the government and the new GBN arms-length body set up to help deliver that extra capacity began the selection process for which SMR technology to use. In October, EDF, GE Hitachi Nuclear Energy, Holtec, NuScale Power, Rolls Royce SMR and Westinghouse were invited to bid for UK government contracts in the next

stage of the process.

Source: <https://www.world-nuclear-news.org/Articles/Agreement-signed-for-planned%2AOUK-fleet-of-AP300-reactors>, 08 February 2024.

The UK government has plans to expand nuclear energy capacity to 24 GW by 2050, with a fleet of SMRs a key part of that strategy. Last year, the government and the new GBN arms-length body set up to help deliver that extra capacity began the selection process for which SMR technology to use. In October, EDF, GE Hitachi Nuclear Energy, Holtec, NuScale Power, Rolls Royce SMR and Westinghouse were invited to bid for UK government contracts in the next stage of the process.

NASA has completed the initial phase of its Fission Surface Power Project, which sought to develop concept designs for a small, electricity-generating nuclear fission reactor that could be used during a future demonstration on the Moon and to inform future designs for Mars. NASA awarded three \$5m contracts in 2022, tasking each commercial partner with developing an initial design that included the reactor.

designs for Mars. NASA awarded three \$5m contracts in 2022, tasking each commercial partner with developing an initial design that included the reactor; its power conversion, heat

rejection, and power management and distribution systems; estimated costs; and a development schedule that could pave the way for powering a sustained human presence on the lunar surface for at least 10 years.

NASA specified that the reactor should stay under 6t and be able to produce 40 kW of electrical power, ensuring enough for demonstration purposes and additional power for running lunar habitats, rovers, backup grids, or science experiments. NASA also set a goal that the reactor should be capable of operating for a decade without human intervention. Safety, especially concerning radiation dose and shielding, was another key driver for the design.

Beyond these set requirements, the partnerships envisioned how the reactor would be remotely powered on and controlled. They identified

USA

NASA Completes Initial Phase of Lunar Nuclear Reactor Project

NASA has completed the initial phase of its Fission Surface Power Project, which sought to develop concept designs for a small, electricity-generating nuclear fission reactor that could be used during a future demonstration on the Moon and to inform future

potential faults and considered different types of fuels and configurations. Having terrestrial nuclear companies paired with companies with expertise in space made for a wide range of ideas. NASA plans to extend the three Phase 1 contracts to gather more information before Phase 2, when industry will be solicited to design the final reactor to demonstrate on the Moon. This additional knowledge will help the agency set the Phase 2 requirements, Kaldon said. After Phase 2, the target date for delivering a reactor to the launch pad is in the early 2030s. On the Moon, the reactor will complete a 1 year demonstration followed by nine operational years. If all goes well, the reactor design may be updated for potential use on Mars.

Source: <https://www.neimagazine.com/news/newsnasa-completes-initial-phase-of-lunar-nuclear-reactor-project-11494315>, 07 February 2024.

NUCLEAR COOPERATION

BELARUS–RUSSIA

Belarus and Russia Aim to Deepen Nuclear Cooperation

A multipurpose nuclear research reactor is one of the possible results of a MoU signed between Russia and Belarus to deepen cooperation in the peaceful uses of nuclear technology. The MoU was signed by Rosatom DG Likhachev and the Chairman of the State Committee on Science and Technology in Belarus, Shlychkov. Belarus and Russia already have close ties in the nuclear field. The first NPP in Belarus, built by Rosatom, is now fully operational after the second VVER-1200 unit

A multipurpose nuclear research reactor is one of the possible results of a MoU signed between Russia and Belarus to deepen cooperation in the peaceful uses of nuclear technology. Belarus and Russia already have close ties in the nuclear field. The first NPP in Belarus, built by Rosatom, is now fully operational after the second VVER-1200 unit was put into commercial operation in November. The plant is located in Ostrovets in the Grodno region.

was put into commercial operation in November. The plant is located in Ostrovets in the Grodno region. A general contract for the construction was signed in 2011, with first concrete in November 2013. Rosatom began construction of unit 2 in May 2014. The first Ostrovets power unit was connected to the grid in November 2020 and, the

energy ministry says, the plant will produce about 18.5 TWh of electricity per year, equivalent to 4.5 billion cubic metres of natural gas, with an annual effect on the country's economy of about USD550 million

Source: <https://www.world-nuclear-news.org/Articles/Belarus-and-Russia-aim-to-deepen-nuclear-cooperati>, 30 January 2024.

INDIA–USA

India-U.S. Civil Nuclear Cooperation “an Important Piece of Unfinished Business”: U.S. Official

Terming the India-U.S. nuclear cooperation envisaged under the nuclear deal two decades ago as “an important piece of unfinished business”, U.S. Assistant Secretary of State for Energy Resources Pyatt said there is a “shared interest” to figure out how the two countries can move forward, both on the large traditional reactors which were foreseen as part of the nuclear deal but also importantly the “fantastic new opportunities” that are emerging around SMR technology.

Elaborating on the civil nuclear cooperation, Mr. Pyatt referred to the conversations he had in India especially at the India-U.S. Forum and said he found strong interest

Terming the India-U.S. nuclear cooperation envisaged under the nuclear deal two decades ago as “an important piece of unfinished business”, U.S. Assistant Secretary of State for Energy Resources Pyatt said there is a “shared interest” to figure out how the two countries can move forward, both on the large traditional reactors which were foreseen as part of the nuclear deal but also importantly the “fantastic new opportunities” that are emerging around SMR technology.

from Indian companies, including Adani, Tata, Reliance, Birla, all of whom have expressed interest in using SMRs as part of their larger decarbonisation strategy. Indian regulations have held up the Indo-U.S. nuclear deal between NPCIL and Westinghouse Electric Company (WEC) for the construction of 6 nuclear reactors in Kovvada, Andhra Pradesh, 8 years after Modi-Obama announced the nuclear deal is done, and worked a way around the Civil Liability for Nuclear Damage Act, 2010, there is still no techno-commercial offer. Speaking of his conversations in India on clean energy and climate change, the Assistant Secretary stressed on getting away from Chinese domination of clean technology supply chains. In this regard, he emphasises in the Indian case, using India's capacities in manufacturing and labour costs to build up a real alternative supply chain, recognising that going forward "one of the pacing factors in the success or failure of our collective energy transition" is going to be our ability to scale the supply chains for everything from solar cells to wind turbines to hydrogen electrolyzers.

Source: <https://www.thehindu.com/news/national/india-us-civil-nuclear-cooperation-an-important-piece-of-unfinished-business-us-official/article67815351.ece>, 05 February 2024.

POLAND–FINLAND

Poland / Finland Companies Sign Agreement on New Nuclear Programme

Finland-based TVO Nuclear Services (TVONS) and Fortum have signed a two-year framework agreement with Polish Polskie Elektryczne Jądrowe (PEJ), a state-owned company responsible for the construction project of the first nuclear power plant in Poland. The companies will support PEJ in the development of operation and maintenance processes of Poland's first nuclear power station. TVONS and Fortum will provide technical support

for the licensing and design phase of the station and help PEJ develop its capabilities to become an operator of a nuclear power plant. PEJ is responsible for the preparation of the investment process for the construction of the first Polish nuclear power station in Pomerania. In November 2022, Warsaw chose Westinghouse to supply its AP1000 reactor technology for the three-unit facility. The first unit is scheduled to be online in 2033 as set in Warsaw's 2020 nuclear energy programme while the start of construction is earmarked for 2026. TVONS is a subsidiary of Finnish nuclear power company Teollisuuden Voima Oyj, which owns and operates the three-unit Olkiluoto nuclear power station. Finland-based Fortum owns and operates Finland's only other nuclear power station, the two-unit Loviisa.

Union Minister Singh said it planned to increase its installed nuclear generating capacity from the current 7480 MWe to 22,800 MWe by 2031-32. He said in order to increase nuclear's share of India's electricity generation the government has approved the construction of ten indigenous 700 MWe pressurised heavy water reactors, created the Indian Nuclear Insurance Pool, amended the Atomic Energy Act to enable joint ventures of public sector companies to set up nuclear power projects.

Source: David Dalton, <https://www.nucnet.org/news/finland-companies-sign-agreement-on-new-nuclear-programme-2-2-2024>, 13 February 2024.

RUSSIA–INDIA

Russia and India Discuss Expanding Nuclear Cooperation

A new protocol to the intergovernmental agreement on the construction of the Kudankulam NPP was signed during a two-day visit by Rosatom DG Likhachev to the Indian plant. Rosatom described the protocol as an "important document" finalised following negotiations which took place during the visit by Likhachev and Mohanty, Chairman of India's Atomic Energy Commission and Secretary of its DAE. India has large-scale expansion plans for nuclear energy.

In a written reply to a question in the Lok Sabha, the lower house of the Indian parliament, Union Minister Singh said it planned to increase its installed nuclear generating capacity from the current 7480 MWe to 22,800 MWe by 2031-32. He said in order to increase nuclear's share of

India's electricity generation the government has approved the construction of ten indigenous 700 MWe pressurised heavy water reactors, created the Indian Nuclear Insurance Pool, amended the Atomic Energy Act to enable joint ventures of public sector companies to set up nuclear power projects, and entered into agreements with foreign countries for nuclear power cooperation, including supply of fuel.

Source: <https://www.world-nuclear-news.org/Articles/Rosatom-boss-optimistic-about-expanding-nuclear-co>, 08 February 2024.

URANIUM PRODUCTION

CANADA

Cameco Looks to Increase Production as Net Earnings Double

The Canadian company said it is strategically positioned to increase tier-one production and plans to begin work to extend the life of the Cigar Lake mine to 2036 as well as looking into expanding production capacity at McArthur River/Key Lake. Net earnings, adjusted net earnings, and cash from operations all more than doubled compared with 2022, the company said in its announcement of results for the fourth quarter and year ended 31 Dec 2023. Cameco's 2023 financial performance benefited from higher sales volumes and realised prices in the company's uranium and fuel services segments, President and CEO Gitzel said, and the company expects "strong financial performance" in 2024 as it begins to "realise the benefits" from its 2023 acquisition, with Brookfield Asset Management, of Westinghouse.

Cameco's attributed 2023 production from McArthur River/Key Lake was 9.4 ml pounds U3O8, with 8.2 ml pounds from Cigar Lake. The company's

The Canadian company said it is strategically positioned to increase tier-one production and plans to begin work to extend the life of the Cigar Lake mine to 2036 as well as looking into expanding production capacity at McArthur River/Key Lake.

total 2023 attributed uranium production of 17.6 ml pounds U3O8 from its Canadian operations was 69% up on 2022 production but 1.1 million pounds below the revised production plans announced by the company in September.

Source: <https://www.world-nuclear-news.org/Articles/Cameco-looks-to-increase-production-as-net-earning> 08 February 2024.

NUCLEAR PROLIFERATION

IRAN

Head of UN's Nuclear Watchdog Warns Iran is 'Not Entirely Transparent' on its Atomic Program

The head of the United Nations' nuclear watchdog warned on 13th Feb that Iran is "not entirely transparent" regarding its atomic program, particularly after an official who once led Tehran's program announced the Islamic Republic has all the pieces for a weapon "in our hands." Speaking at the World Government Summit in Dubai, just across the Persian Gulf, Rafael Mariano Grossi, the director-general of the IAEA, alluded to remarks made this weekend by Ali Akbar Salehi. Grossi noted "an accumulation of complexities" in the wider Middle East amid Israel's war against Hamas in the Gaza Strip.

Iran is "presenting a face which is not entirely transparent when it comes to its nuclear activities. Of course this increases dangers," Grossi warned. "There's loose talk about nuclear weapons more and more, including in Iran recently. A very high official said, in fact, we have everything, it's disassembled. Well, please let me know what you have.

Iran, after the collapse of its 2015 nuclear deal with world powers, has pursued nuclear enrichment just below weapons-grade levels. Tehran has accumulated enough enriched uranium to build several weapons, if it so chose. However, US intelligence agencies and others assess that Iran has yet to begin a weapons program. Israel long has been believed to have its own nuclear weapons program.

Iran is "presenting a face which is not entirely transparent when it comes to its nuclear activities. Of course this increases dangers," Grossi warned.

"There's loose talk about nuclear weapons more and more, including in Iran recently. A very high official said, in fact, we have everything, it's disassembled. Well, please let me know what you have."

Grossi did not identify the official. However, in a late night Iranian state television show on Sunday, Salehi appeared and said that the country had all it needed to build a weapon. "We have all the (pieces) of nuclear science and technology. Let me give an example," Salehi said. "What does a car need? It needs a chassis, it needs an engine, it needs a steering wheel, it needs a gearbox. Have you made a gearbox? I say yes. An engine? But each one is for its own purpose."...

Source: <https://timesofindia.indiatimes.com/world/middle-east/head-of-uns-nuclear-watchdog-warns-iran-is-not-entirely-transparent-on-its-atomic-program/articleshowprint/107660370.cms>, 13 February 2024.

NORTH KOREA

Cyber-attacks by North Korea Raked in \$3bn to Build Nuclear Weapons, UN Monitors Suspect

Report is said to show that attacks on cryptocurrency-related companies helped development of dictatorship's weapons programme. UN sanctions monitors are investigating dozens of suspected cyber-attacks by North Korea that raked in \$3bn to help it further develop its nuclear weapons programme, according to excerpts of an unpublished UN report. North Korea's mission to the UN in New York did not immediately respond to a request for comment on sanctions monitors' the report. Pyongyang has previously denied allegations of hacking or other cyber-attacks. The UN report was due to be released publicly this month or early next month, diplomats said.

North Korean hacking groups subordinate to

Pyongyang's primary foreign intelligence agency reportedly continued with a high number of cyber-attacks, the sanctions monitors said. North Korea has long been banned from conducting nuclear

tests and ballistic missile launches by the 15-member security council. Since 2006 it has been subject to UN sanctions, which the council has repeatedly strengthened to try to cut off funding for developing WMD. Any further action against North Korea by the council is unlikely as it has been deadlocked for

several years on the issue. China and Russia instead want the sanctions to be eased to convince Pyongyang to return to denuclearisation talks.

Source: <https://www.theguardian.com/world/2024/feb/08/cyber-attacks-by-north-korea-raked-in-3bn-to-build-nuclear-weapons-un-monitors-suspect>, 08 February 2024.

NUCLEAR SAFETY

JAPAN

Fukushima Nuclear Plant Operator Told to Communicate Better with the Public After Leak

A panel of safety experts on Tuesday [13 Feb] urged the operator of the tsunami-wrecked Fukushima Daiichi nuclear power plant in Japan to communicate more quickly with the public over incidents such as last week's leak of contaminated water. Thirteen years after the Fukushima disaster in which the plant suffered triple meltdowns following the 2011 earthquake, safety culture at the Tokyo Electric Power Company Holdings company has improved but there is still work to do, said Dale Klein, a former U.S. Nuclear Regulatory Commission chairperson who now serves as an advisor to TEPCO's reform committee.

The panel's news briefing on its periodic assessment came a week after highly radioactive water leaked from a treatment machine during

maintenance work at the Fukushima Daiichi plant. TEPCO said no one was injured, and radiation monitoring shows no leakage escaped the compound. But the leak triggered criticism in and outside Japan. Any leak of radioactive water is a sensitive topic.

In another accidental leak in October, four workers were sprayed with radioactive liquid waste while cleaning a treatment facility. Two were briefly hospitalized for skin contamination, though none showed symptoms of poisoning. Klein said both incidents could have been prevented, and TEPCO needs to quickly analyze what happened in such mishaps and "very quickly communicate to the public what happened and why." For risk control, many companies, including TEPCO, often try to know everything before they say anything publicly, Klein said. But in the age of social media, speculation spreads quickly, he said. The filtering machine involved in last week's incident is part of TEPCO's controversial wastewater discharge project, which began in August.

The discharges, expected to continue for decades, have been strongly opposed by fishing groups and neighboring countries including China, which banned imports of all Japanese seafood. The Japanese government hopes the IAEA's assistance and reviews affirming the discharges have met international safety standards would further help address concerns in and outside the country. The TEPCO safety experts acknowledged improved safety culture at TEPCO. It noted the Nuclear Regulation Authority's lifting of a suspension on the utility to resume preparations to restart another nuclear power plant, Kashiwazaki-Kariwa, after addressing lax safeguarding measures. The next big hurdle is consent from the local community. ...

Source: [https://www.nbcnews.com/news/world/japan-fukushima-nuclear-plant-leak-operator-](https://www.nbcnews.com/news/world/japan-fukushima-nuclear-plant-leak-operator-communicate-better-rcna138623)

[communicate-better-rcna138623](https://www.nbcnews.com/news/world/japan-fukushima-nuclear-plant-leak-operator-communicate-better-rcna138623), 13 February 2024.

Contaminated Water Leak at Fukushima Daiichi

A leak of contaminated water has been discovered from a pipe connected to a caesium adsorption device at the damaged Fukushima Daiichi NPP in Japan. The leak has been stopped and Tepco said it will check soil beneath the pipe for contamination. Tepco said that at about 8.52am on 7 Feb a worker from a contracted company found that water was leaking from the vent opening of the second cesium adsorption device installed on the east wall of the high-temperature and high-pressure incinerator building. The vent is for discharging hydrogen generated within the adsorption device. The second cesium adsorption device was currently out of service and was undergoing flushing work with filtered water for valve inspections. At around 9.10am, the main valve for filtered water was closed, and at around 9.16am, Tepco confirmed that the water had stopped leaking. The water had leaked onto metal plates located below the leaking pipe. Tepco estimates that about 5.5 t of water leaked from the pipe, which may contain 22 bl becquerels of radioactive materials, such as caesium and strontium.

Source: [https://www.world-nuclear-news.org/Articles/](https://www.world-nuclear-news.org/Articles/Contaminated-water-leak-at-Fukushima-Daiichi)

[Contaminated-water-leak-at-Fukushima-Daiichi](https://www.world-nuclear-news.org/Articles/Contaminated-water-leak-at-Fukushima-Daiichi), 07 February 2024.

UK

UK Strengthens Nuclear Regulation, IAEA Mission Finds

The UK has a strong commitment to nuclear and radiation safety and has made progress to reinforce its regulatory functions, although recruitment challenges remain, an IAEA team of experts said following its completion of a follow-up Integrated Regulatory Review Service (IRRS)

The panel's news briefing on its periodic assessment came a week after highly radioactive water leaked from a treatment machine during maintenance work at the Fukushima Daiichi plant. TEPCO said no one was injured, and radiation monitoring shows no leakage escaped the compound.

A leak of contaminated water has been discovered from a pipe connected to a caesium adsorption device at the damaged Fukushima Daiichi NPP in Japan. The leak has been stopped and Tepco said it will check soil beneath the pipe for contamination.

mission. IRRS missions are designed to strengthen the effectiveness of the national nuclear and radiation safety regulatory infrastructure, based on IAEA safety standards and international good practices, while recognising the responsibility of each country to ensure nuclear and radiation safety. The seven-day follow-up IRRS mission was conducted at the request of the UK government and took place at the headquarters of the Health and Safety Executive (HSE) and Office for Nuclear Regulation (ONR), in Bootle, near Liverpool. Its purpose was to evaluate the implementation of 24 recommendations and 19 suggestions provided during the initial full-scope IRRS mission in October 2019.

In its report, the team made six new findings consisting of four recommendations and two suggestions in relation to the topics covered during the IRRS initial mission. In particular, the team noted that the inability to recruit and retain specialists and inspectors has had an impact on the regulatory processes of some bodies and recommended a pay reform where required in order to ensure the statutory remit is delivered.

Source: <https://www.world-nuclear-news.org/Articles/UK-strengthens-nuclear-regulation,-IAEA-mission-fi>, 01 February 2024.

UKRAINE

IAEA's Grossi Visits Zaporizhzhia NPP

IAEA DG Grossi has travelled across the military frontline to visit the Zaporizhzhia NPP for a fourth time. The Zaporizhzhia NPP, which has six units and is Ukraine and Europe's largest, has been under Russian military control since early March 2022 and is located very close to the frontline of Russian and Ukrainian forces. During his visit,

Grossi was briefed on the current state of the plant by director Chernichuk. Grossi is expected to travel to Moscow for more talks relating to safety and security issues at the plant in the next two weeks. During their meeting, President Zelensky emphasised that his view was that the only way to prevent a nuclear accident at the Zaporizhzhia NPP was its full demilitarisation, de-occupation and restoration of control over the plant by Ukraine.

Source: <https://www.world-nuclear-news.org/Articles/IAEA-s-Grossi-visits-Zaporizhzhia-nuclear-power-pl>, 07 February 2024.

NUCLEAR SECURITY

TURKEY

'Russian' Daesh Member Nabbed Working at Nuclear Plant in Türkiye

Turkish media outlets reported that a Russian man was detained on charges of links to the Daesh terrorist group on Tuesday [13 Feb]. The man was caught working under a fake identity at the \$20 billion Akkuyu nuclear plant, which is being built by Russian conglomerate Rosatom in the Mediterranean province of Mersin, security sources said. Police in Mersin said that a Turkish court formally arrested the foreign national. Its statement did not specify the suspect's nationality or give further details on the operation.

In December, Turkish authorities granted permission for the commissioning of the first power-generating unit of Akkuyu, the country's first nuclear power plant. The plant is expected to be fully operational by 2028 and supply 10% of Türkiye's electricity consumption. Last week, Interior Minister Ali Yerlikaya said Türkiye had

The UK has a strong commitment to nuclear and radiation safety and has made progress to reinforce its regulatory functions, although recruitment challenges remain, an IAEA team of experts said following its completion of a follow-up Integrated Regulatory Review Service (IRRS) mission.

Grossi is expected to travel to Moscow for more talks relating to safety and security issues at the plant in the next two weeks. During their meeting, President Zelensky emphasised that his view was that the only way to prevent a nuclear accident at the Zaporizhzhia NPP was its full demilitarisation, de-occupation and restoration of control over the plant by Ukraine.

detained 147 people suspected of having ties to Daesh in operations across 33 provinces. Last month, one Turkish citizen was killed by two Daesh gunmen at the Italian Santa Maria Catholic Church in Istanbul. Turkish police detained two people suspected of carrying out the attack. Daesh remains the second biggest threat of terrorism for Türkiye, which faces security risks from multiple terrorist groups. ...

Source: <https://www.dailysabah.com/politics/war-on-terror/russian-daesh-member-nabbed-working-at-nuclear-plant-in-turkiye>, 13 February 2024.

NUCLEAR WASTE MANAGEMENT

FRANCE–SWEDEN

Nuvia to Carry Out Ringhals Decommissioning Work

Nuvia, a subsidiary of France's Vinci construction group, has been awarded a contract by Vattenfall to remove, inspect and sort the radioactive and other materials currently inside the reactor buildings of units 1 and 2 at the Ringhals NPP in Sweden. The works on site are planned to be carried out from mid-2025 to 2031, will mobilise up to 400 people and involve the processing of more than 30,000 t of materials. This work will prepare for the future conventional demolition of the reinforced-concrete structures of the two units. Vattenfall estimates that the entire demolition process will take around 8-10 years. Vinci noted that Nuvia - which is active in Sweden through its subsidiary Nuvia Nordic AB - has participated in most of the country's nuclear dismantling projects so far. In 2022, Nuvia was

Nuvia, a subsidiary of France's Vinci construction group, has been awarded a contract by Vattenfall to remove, inspect and sort the radioactive and other materials currently inside the reactor buildings of units 1 and 2 at the Ringhals NPP in Sweden. The works on site are planned to be carried out from mid-2025 to 2031, will mobilise up to 400 people and involve the processing of more than 30,000 t of materials.

Source: <https://www.world-nuclear-news.org/Articles/Nuvia-to-carry-out-Ringhals-decommissioning-work>, 02 February 2024.

UK

UK Decommissioning Research Partnership Begins to Bear Fruit

A research partnership between the UK's Nuclear Decommissioning Authority (NDA) and National Decommissioning Centre (NDC), formed in 2022, is already helping the energy sector to reduce costs and emissions, improve environmental outcomes and deliver sustainable net-zero decommissioning.

A research partnership between the UK's Nuclear Decommissioning Authority (NDA) and National Decommissioning Centre (NDC), formed in 2022, is already helping the energy sector to reduce costs and emissions, improve environmental outcomes and deliver sustainable net-zero decommissioning.

The NDC - based near Aberdeen, Scotland - is a GBP38 M partnership between the University of Aberdeen, Net Zero Technology Centre (NZTC) and industry. NZTC develops and deploys technology to accelerate an affordable net-zero energy industry.

Founded in 2017, the centre was created as part of the Aberdeen City Region Deal, with GBP180 M of UK and Scottish government funding. In September 2022, the NDA and NDC signed a three-year collaborative research agreement - the first of its kind between the nuclear and oil and gas decommissioning sectors. The partnership, supporting research with a potential value of up to GBP900,000, sees the NDA work with researchers from the University of Aberdeen in

areas of mutual interest to both the nuclear and oil and gas sectors. The agreement built on three years of discussions involving the NDA, the NDC, Net Zero Technology Centre, regulators including the North Sea Transition Authority, and industry bodies, which sought to identify mutually beneficial opportunities through the insights and lessons learned from each sector. Among the areas identified for joint research are the development

of AI-based techniques to support risk management, sharing new technology development, analysing impact on the economy and environment and finding environmentally safe alternatives to cement.

Source: <https://www.world-nuclear-news.org/Articles/UK-decommissioning-research-partnership-begins-to>, 02 February 2024.



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

P-284

Arjan Path, Subroto Park,

New Delhi - 110010

Tel.: +91 - 11 - 25699131/32

Fax: +91 - 11 - 25682533

Email: capsnetdroff@gmail.com

Website: www.capsindia.org

Edited by: Director General, CAPS

Editorial Team: Dr. Sitakanta Mishra, Rishika Singh, Jay Desai, Dr. Ngangom Dhruva Tara Singh, Abhinav Shankar Goswami Ritika Mourya, Javed Alam

Composed by: CAPS

Disclaimer: Information and data included in this newsletter is for educational non-commercial purposes only and has been carefully adapted, excerpted or edited from sources deemed reliable and accurate at the time of preparation. The Centre does not accept any liability for error therein. All copyrighted material belongs to respective owners and is provided only for purposes of wider dissemination.