



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 material belongs to respective owners and is provided only for purposes of wider dissemination.

OPINION – Debajit Sarkar

Vol 15, No. 18, 15 JULY 2021

Nuclear Force: Why India Needs to Increase its Nuclear Stockpile

Since the Cold War bilateral treaties between the US and Russia like START- 1 ensured that the number of nuclear weapons in the world declines significantly. However, even today in order to maintain parity both the US and Russia continue to modernize their nuclear forces. The other UN P-5 nuclear powers notably China, UK and France have also earmarked billions of dollars to modernize their nuclear force.

Thousands of US and Russian nuclear warheads continue to remain on high alert, ready for use on short notice. Most nuclear-armed states provide little or no information about the exact size of their nuclear arsenal. So, any information related to the size and composition of the nuclear weapon stockpiles of any country are just estimates.

Most US and Russian SLBMs carry MIRVs. The only exceptions were MARV, or very large warhead models designed for hard targets like deeply buried bunkers. Russia's Topol ICBM was a single warhead missile by design, but later generation Russian missiles are designed for more than one

Thousands of US and Russian nuclear warheads continue to remain on high alert, ready for use on short notice. Most nuclear-armed states provide little or no information about the exact size of their nuclear arsenal. So, any information related to the size and composition of the nuclear weapon stockpiles of any country are just estimates.

CONTENTS

- ☞ **OPINION**
- ☞ **NUCLEAR STRATEGY**
- ☞ **BALLISTIC MISSILE DEFENCE**
- ☞ **EMERGING TECHNOLOGIES AND DETERRENCE**
- ☞ **NUCLEAR ENERGY**
- ☞ **NUCLEAR COOPERATION**
- ☞ **NUCLEAR PROLIFERATION**
- ☞ **NUCLEAR DISARMAMENT**
- ☞ **NUCLEAR SAFETY**
- ☞ **NUCLEAR WASTE MANAGEMENT**

warhead. One version of the R-36M ICBM (NATO reporting name: SS-18 Satan) had a 20-megaton single warhead.

Anti-Ballistic Missile Defense: The Grey Area: It is extremely difficult to shoot down an incoming missile warhead with an ABM because not only are missile warheads small but

they travel at great speeds, faster than even a rifle bullet. Then there are several other variables related to the incoming warhead like trajectory,

characteristics, decoys that will not be known to the ABM operators. Many ICBMs can carry 5 to 10 warheads and about 30 or more decoys. If a single ICBM with ten warheads and 100 decoys were launched against India, no less than 110 interceptors would be required to destroy them preferably outside the Earth's atmosphere. Warheads can also be made to manoeuvre, and they can do so in a variety of ways making interception almost impossible.

India's Nuclear Weapons: Requirement for

Credibility: For the Indian government the primary purpose of nuclear weapons has always been to dissuade any possible adversary from attacking India or our vital interests.

Western intelligence community are of the opinion that China has many more nuclear warheads than the commonly quoted figure of 350. China's missile force is the most diversified on the planet, with more ballistic missiles launched for testing and training than the rest of the world combined. China's recent decision to outfit some of its ICBMs with MIRVs, as well as Pakistan's announcement in January 2017 that it had successfully test-fired a new 2000 kms range ballistic missile called Ababeel with MIRVs are both noteworthy because for Pakistan it reflects a strategy to quickly strike multiple targets across India. The long-range strategic missile that China has developed include DF-41, DF-31, DF-31A, DF-4, and DF-5 ground-based missiles, and JL-1 and new JL-2 submarine-launched missiles.

In the case of a nuclear strike, India's leadership should focus on a comprehensive counter-offensive strategy aimed at removing an

adversary's ability to cause further harm to Indian interests. For this strategy to be successful India needs to drastically increase its stockpile of nuclear weapons so that it dwarfs the combined nuclear stockpile of both China and Pakistan. Such strike capability needs to be backed up by advanced real-time imagery and data fusion powered by Edge Computing that will allow precision strike of even the adversary's road mobile and rail mobile missiles. Some of the missions now assigned to nuclear weapons may be addressed by conventional precision strike weapons, but not all of them. Some targets, such as missile silos and command and control centres, are so difficult to destroy that no conventional weapon will be able to do it. Many hard targets could be defeated with nuclear explosives with lower yields if they are delivered with precision.

BARC had published their radio-chemical analytical estimate of the S-1 (Fusion Weapon) yield shortly after POKHRAN II. The raw data has been withheld because it could reveal weapon design details. It does, however, provide a qualitative technique of determining the tests' efficacy. It will be difficult for India to field a new, highly optimized, nuclear warhead design without nuclear testing. Therefore, existing nuclear designs will have to be maintained. Simulations of nuclear explosions can only go so far: and that confidence in the performance of a system can only be gained by actual testing. The simulation is worthless without the empirical validation. The K-5 SLBM that is currently being developed should be able to carry at least 3 MIRV and once the weight of these warheads is further reduced thereby improving the yield-to-weight

China's recent decision to outfit some of its ICBMs with MIRVs, as well as Pakistan's announcement in January 2017 that it had successfully test-fired a new 2000 kms range ballistic missile called Ababeel with MIRVs are both noteworthy because for Pakistan it reflects a strategy to quickly strike multiple targets across India.

In the case of a nuclear strike, India's leadership should focus on a comprehensive counter-offensive strategy aimed at removing an adversary's ability to cause further harm to Indian interests. For this strategy to be successful India needs to drastically increase its stockpile of nuclear weapons so that it dwarfs the combined nuclear stockpile of both China and Pakistan.

ratio the K-5 as well at the Agni 5 should be able to carry 5 MIRVs.

The survivability of India's nuclear force to the possibility of a disarming first strike is a crucial requirement for credibility. India does not need to threaten cities or population of the adversary although that's a potent element of the deterrent calculus. The Indian government must view nuclear weapons as part of a comprehensive national security strategy that includes diplomacy, arms control initiatives, and conventional forces to maximize stability and peace in the region.

Source: <https://www.financialexpress.com/defence/nuclear-force-why-india-needs-to-increase-its-nuclear-stockpile/2279565/>, 28 June 2021.

OPINION – Jaijit Bhattacharya

Peace Prize for the Nuclear Bomb?

The nuclear bomb was first used for one of the biggest terrorist actions in the history of humankind. As per the definition given by the UN panel, on March 17, 2005, terrorism is as any act "intended to cause death or serious bodily harm to civilians or non-combatants to intimidate a population or compel a government or an international organization to do or abstain from doing any act." The purpose of bombing of Hiroshima and Nagasaki on August 6th and 9th of 1945, that killed millions of civilians instantly, and killed many more painfully over the years, was only to intimidate the Japanese government into submission. It was indeed the most gruesome act of terrorism in the history of humans.

So then why should I be seeking a global recognition for the contributions made toward

world peace by the nuclear bomb? It is because the Bomb was arguably the key deterrent for stopping the outbreak of any large scale global conflict since 1945. There has not been a repeat of the intense savagery of World War II that was played out in Europe and in other places of the world, driven by power-hungry western nations. We have had smaller conflicts around the world, but we have not had any major global flare-ups. Even at the peak of the cold war between the USA and its allies and the

The K-5 SLBM that is currently being developed should be able to carry at least 3 MIRV and once the weight of these warheads is further reduced thereby improving the yield-to-weight ratio the K-5 as well at the Agni 5 should be able to carry 5 MIRVs.

Russian bloc, the Bomb ensured that the war stayed cold, and never heat up, except for small proxy wars in places such as Korea, Vietnam, Afghanistan and so on. The closest that the world came to a global war breaking out, was the Bay of Pigs – Cuban missiles crisis incident, and there too, the threat of mutual destruction due to the Bomb, ensured that better senses prevailed.

One may argue, that it was not the Bomb but the effective operationalization of the UN that really prevented any major conflicts. That would be naïve at best. The UN was conceived from the ashes of the League of Nations that was formed after WW I, to prevent another world war. The institutional structure of the League of Nations itself ensured that all nations do not have an equal voice, and hence it fell like a house of cards as the Japanese representative walked out

We have had smaller conflicts around the world, but we have not had any major global flare-ups. Even at the peak of the cold war between the USA and its allies and the Russian bloc, the Bomb ensured that the war stayed cold, and never heat up, except for small proxy wars in places such as Korea, Vietnam, Afghanistan and so on.

with a single phrase – "Japan rejects". This was the rejection of the commission of inquiry report that found Japan to be in violation of the League's Covenant for its invasion of Manchuria. Also, the then powers were reluctant or incapable of imposing any sanctions on Japan. The Japanese rejection of the commission of inquiry report led to a series of events that led to the collapse of the League of Nations, coinciding with WW II.

If we look at the UN as it stands today, tiny nations such as UK and France are permanent members of the supposedly powerful UN Security Council, while nations such as India, Indonesia, Bangladesh, Nigeria and Brazil, which together constitutes over a quarter of global population, are pretty much kept at the fringes. Even from a GDP perspective, it leaves out India and Japan, who have two times and three times the GDP of Russia respectively. There are clearly fault lines in the institutional structure of the UN. The UN bodies are also susceptible to "capturing", as has been the murmurings on the various bodies of the UN, with the WHO being a case in point. The WHO's dealing of the Wuhan pandemic, and its unnatural pandering to China's untenable narratives on the Wuhan virus, exposed how a UN body can be compromised.

Scrutinizing the report card of the UN more closely, it was unable to stop the annexation of Tibet, by China. It was unable to stop the Iran-Iraq wars or the North Korea-South Korea wars or the Ehtioipia-Somalia conflicts or the Kosovo conflict or many of the smaller wars all over the world. It was also unable to stop the marching of US troops twice into Iraq and once into Afghanistan. The only pattern that one sees in these wars is that they were all between either non-nuclear nations or where one of the nations involved in the conflict was non-nuclear. Nuclear nations did not go to war with each other, till we had the Kargil war between Indian and Pakistan. And even the Kargil war did not flare up to a full-fledged war due to the overbearing threat of a nuclear war. So clearly, the UN has not been able to fulfil its role of preventing conflicts, whereas the nuclear bomb appears to have been extremely effective in preventing conflicts. In fact, had it not been for

The only pattern that one sees in these wars is that they were all between either non-nuclear nations or where one of the nations involved in the conflict was non-nuclear. Nuclear nations did not go to war with each other, till we had the Kargil war between Indian and Pakistan. And even the Kargil war did not flare up to a full-fledged war due to the overbearing threat of a nuclear war.

In fact, China's strategy of snatching territories from its neighbours through salami cuts, is designed to keep the conflict below the nuclear threshold and be able to get away with the territory snatching.

the nuclear bomb, perhaps the UN itself would have collapsed by now, pretty much like its predecessor, the League of Nations.

Thus, we have not had any hot world war for over 75 years, perhaps thanks to the terrible nuclear bomb. Even the recent aggression by nuclear China on nuclear India, which led to many soldiers dying on both sides in hand-to-hand combat, has possibly been brought under control due to the threat of the conflict escalating into a nuclear conflict. In fact, China's strategy of snatching territories from its neighbours through salami cuts, is designed to keep the conflict below the nuclear threshold and be able to get away with the territory snatching. Had it not been for the nuclear bomb, we would have seen bigger misadventurism from irresponsible global powers such as China, which would have quickly degenerated into another world war.

Hence, it is high time to recognize the role of the Bomb in providing us with peace, albeit at an exceptionally high initial cost of millions of Japanese lives. With the hope that this deadly weapon does not fall into the hands of non-state actors, perhaps it is time that the Bomb is recognized for its contribution to global peace.

Source: <https://www.outlookindia.com/website/story/opinion-peace-prize-for-the-nuclear-bomb/387185>, 06 July 2021.

OPINION – John Letzig

Can the World Ever Learn to Love Nuclear Power?

When I was three years old, a reactor at the nuclear power plant 30 kilometres east of our split-level suburban home partially melted down. Like

most people in the neighborhood, when my parents heard about the trouble at Three Mile Island, they considered loading up the family station wagon and fleeing. Like most people in the neighborhood, they didn't.

Several years after the worst nuclear accident in US history, a Columbia University study couldn't establish a clear connection between the radioactive gas it released and elevated local cancer rates. Yet by that point, the public was in no mood to hear about the relative safety of splitting atoms.

In a strange coincidence, a Hollywood blockbuster about the perils of nuclear power was released just days before the incident at Three Mile Island. "The China Syndrome" benefited from auspicious timing, but it was just part of a long thread of similarly themed, similarly alarming entertainment. Headlines generated by events like the Fukushima disaster in Japan have only further hardened public opinion. But what if this source of so much collective anxiety is also one of our best bets for averting a climate catastrophe?

How the World Views Nuclear Energy: An irony noted at the time of the 2019 closure of Three Mile Island, which had provided nearly all of Pennsylvania's carbon-free energy, was that it occurred on the same day activists around the world took to the streets to call for climate action. One action that could help prevent a devastating degree of global warming, according to scientists and economists convened by the UN: increase the percentage of electricity we get from nuclear energy, even potentially quintuple it by 2050.

Much of the world remains unconvinced. When Japan recently restarted a nuclear reactor meant to help the country cut emissions, it was met with

alarm. And California is shutting down the state's last nuclear power plant – a facility targeted by activists in the wake of Three Mile Island – though it's unclear whether a spike in emissions will follow. Nuclear power proponents point to its safety relative to other electricity sources, and say a "not in my backyard" (NIMBY) attitude hinders development – though not everywhere.

"Hard to be a NIMBY in China," as one American journalist quipped. China has doubled its nuclear capacity recently, and is likely to maintain that pace at least until 2025.

The science of atomic radiation originated in the late 19th century, and interest in harnessing

nuclear fission peaked during the 20th. Militaries prized it as a means to power submarines and put vessels out to sea for long periods without having to refuel. The first nuclear power plant was connected to an electricity grid in the Soviet Union in 1954, and plants in the UK and the US soon followed. Hundreds more have been built subsequently, as critics have raised issues related

to safety, human rights violations, nuclear weapons proliferation and waste that can remain lethal for thousands of years.

Germany has decided the risks aren't worth it, and is phasing out nuclear power it aims to achieve net-zero

emissions by 2045. A next generation of nuclear reactors could improve safety and efficiency. "Small modular reactors" may produce less energy individually, but can be scaled up as needed. They also include added safety features. One company founded by Bill Gates has developed a "Natrium" reactor technology that stores heat in molten salt and is designed to work well with renewables. It recently announced plans for a pilot project in Wyoming.

Several years after the worst nuclear accident in US history, a Columbia University study couldn't establish a clear connection between the radioactive gas it released and elevated local cancer rates. Yet by that point, the public was in no mood to hear about the relative safety of splitting atoms.

One action that could help prevent a devastating degree of global warming, according to scientists and economists convened by the UN: increase the percentage of electricity we get from nuclear energy, even potentially quintuple it by 2050.

About 440 reactors – the number of operable reactors has remained relatively flat for decades – currently supply about 10% of the world’s electricity. However, dozens more are under construction. Nuclear energy promises to be a source of lively debate at the UN Climate Change Conference of the Parties (COP26) scheduled to begin in October. Meanwhile, new research on the impact of the accident at Three Mile Island continues to be published...

Source: <https://www.weforum.org/agenda/2021/07/can-the-world-ever-learn-to-love-nuclear-power/>, 01 July 2021.

OPINION – Van Jackson

Time for US Nuclear Strategy to Embrace No First Use

It was one of the most potent lessons of the Cold War — nukes are good for deterring others from using nukes, but not much else. Weapons capable only of spasmodic mass violence are too crude as a credible tool of coercion in most circumstances. If the US seeks only deterrence, but not political advantage from nuclear weapons, then adopting a no-first use nuclear policy is not just low-risk — it’s necessary. Most of the leading candidates campaigning for the 2020 Democratic presidential nomination publicly endorsed a no-first use policy. Legislation requiring it has growing support in the US Congress. Indeed, it is difficult to imagine any scenario where the US gains from using nuclear weapons before an adversary, especially when Washington’s conventional arsenal has global reach.

A no-first use nuclear policy would therefore be honest nuclear policy. No sane president would

If the US seeks only deterrence, but not political advantage from nuclear weapons, then adopting a no-first use nuclear policy is not just low-risk — it’s necessary. Most of the leading candidates campaigning for the 2020 Democratic presidential nomination publicly endorsed a no-first use policy. Legislation requiring it has growing support in the US Congress.

use nuclear weapons before an adversary did, except perhaps out of tragic misperception. But since the Trump presidency, the imperative of a no-first use policy has grown more urgent.

Only a fool would trust in US strategic competence after the decision-making of the Trump era. Trump was a symptom not an anomaly of US politics today. He has spawned many imitators in the Republican Party, who traffic in conspiracy

theories and promote antagonistic, militaristic and racialised foreign policies to score domestic political points. Who wants to entrust a candidate of the far right with the authority to launch nuclear weapons? No first use is the most meagre of many measures needed to restrain US presidential authority in the nuclear realm.

While US President Biden has spoken favourably about a no-first use policy in the past, his administration’s nuclear thinking is so far mostly indistinguishable from that of the Trump era. In the past four years, the US has withdrawn from

most arms control agreements, expanded investments in hypersonic glide vehicles, advanced development of low-yield ‘tactical’ nuclear weapons, threatened nuclear use in the most gratuitous ways, and committed to a US\$1.5 trillion nuclear modernisation plan. Why,

then, would preserving a first-use nuclear option be a good idea, especially when the context is not one of US restraint but rather an uninhibited US arms build-up? Opponents of no first use offer three justifications.

First, nuclear advocates claim that China, Russia and North Korea won’t believe no-first use declarations. Yet the fact that it sometimes pays to deceive in statecraft does not repudiate a no-first use policy. If adversaries assume the worst about US nuclear planning, what’s the harm in

claiming they need not worry about US nukes unless they use theirs?

If the credibility of a pledge is a priority, Washington can strengthen it through additional changes. Legislation constraining presidential authority is one mechanism, so is eliminating the ICBM component of the nuclear triad, re-entering arms control agreements abandoned during the Trump years, and curbing investments in intermediate-range ground-launched missiles and 'tactical' nuclear warheads. When multiple signals are combined with a common message — especially costly and hand-tying signals — the context in which judgments are made changes and declarations become credible.

Second, an ambiguous policy encourages enemy uncertainty about whether the United States could use nuclear weapons against them. This is supposed to keep adversaries from using nuclear weapons against the US or its allies. But in what scenarios do Washington's enemies think it will use nuclear weapons first when the US has conventional munitions with global reach? If a credible threat of nuclear retaliation cannot deter China, Russia or North Korea, why would an ambiguous US nuclear policy? US nuclear threats will not keep aggressors from making land grabs, threat-making or invading neighbouring territory. The notion that the US should keep enemies guessing about its intentions on nuclear strategy imports battlefield logic into peacetime circumstances.

If the US really saw fit to make nuclear first-use threats in conflict, shifting from no-first use to a declaratory policy of ambiguity would be better for 'keeping the enemy guessing'. There is no peacetime deterrence gained from allowing the fog of war to shroud geopolitics at all times. The

third argument is that allies reliant on US extended nuclear deterrence would worry about Washington's ability or willingness to deter threats on their behalf. So, what? No ally is in it just for the nukes. Because allies' fears of abandonment or entrapment can never be fully mollified, the US must be cautious about being held hostage to them.

In extremis, the absence of US extended deterrence for Japan, South Korea or Australia could mean them

going nuclear. But the old bargain — Washington does arms-racing so allies don't — makes no sense in a world where US politics is depressingly awry. Allied nuclear proliferation poses its own risks, but it may be a better alternative to US nuclear preponderance and presidential first-use launch authority.

While the arguments against a no-first use policy don't add up on their merits, reasonable people have long debated these points. But circumstances have changed dramatically. Nuclear policy must reconsider giving a potentially unhinged or fascist president the discretion to launch nuclear weapons before America's enemies do. If the aim is to make US foreign policy less reliant on nuclear weapons over time while minimising risks of nuclear war, adopting no first use is the least the US can do to make a down payment on a saner world.

Source: <https://www.eastasiaforum.org/2021/07/04/time-for-us-nuclear-strategy-to-embrace-no-first-use/>, 04 July 2021.

US nuclear threats will not keep aggressors from making land grabs, threat-making or invading neighbouring territory. The notion that the US should keep enemies guessing about its intentions on nuclear strategy imports battlefield logic into peacetime circumstances.

If the aim is to make US foreign policy less reliant on nuclear weapons over time while minimising risks of nuclear war, adopting no first use is the least the US can do to make a down payment on a saner world.

OPINION – Franklin Miller, Peter Huessy

Seven Deadly Misconceptions About Nuclear Deterrence

During the debate over the nuclear deterrent policy of the US, the average person will hear many misconceptions about that policy advanced as

“statements of fact.” But these aren’t facts, they are really just ideological tropes. Seven very earnestly held misconceptions tend to dominate the nuclear debating landscape and deserve to be examined.

The first misconception is that national nuclear policies are reciprocal. There is no difference between the policies of the US and those of Russia and China. There is moral equivalency between all three policies. What would deter the president of the US is the same as what would deter Russian president Putin, Chinese leader Xi Jinping, or even North Korea’s crafty Kim Jong-un.

US nuclear deterrence policy, in the broadest sense, is virtually unchanged since the Kennedy years. America’s nuclear weapons serve to deter nuclear attacks on the US and its allies and, as a last resort, to deter major non-nuclear strategic attacks. US policy and programs seek to make clear to potential aggressor leaderships that there will be no winners in a nuclear war, and that an act of armed aggression against the US or its allies risks escalation to nuclear war and the destruction of the aggressor’s homeland.

Conversely, over the past decade and a half, Russian nuclear strategy has evolved into one seeking offensively to menace and intimidate Moscow’s neighbors (many of whom also happen to be our allies). As part of this, it appears that the Kremlin leadership contemplates the use of low-yield weapons to consolidate aggressive gains accomplished by conventional means. Chinese nuclear strategy remains, as it always has, opaque, but there is strong and emerging intelligence that Beijing is studying and adopting

the Russian model.

As a result, a person cannot approach deterring Putin or Xi as if they were benign democratically elected leaders. These men, and the coterie of advisers, courtiers, and mobsters who surround them, are interested in power and in the use of power, both at home and abroad. If they believe they can commit aggression at no or little cost, then the prize might seem worth the risk. For Putin, the prize is reassembling in some form or another the failed Soviet state, in restricting the freedoms of his democratically-oriented neighbors, and in expanding Russian influence while reducing US influence in Europe. When he deems the cost to be low, he does not hesitate. The world has watched this occur in Georgia, in Crimea, in Eastern Ukraine, and in Syria.

For Xi, the goal similarly is restoring China to great-power status. This goal will likely be accomplished by turning the South China Sea into a Chinese inland lake and by systematically eliminating internal opposition and eliminating ethnic minorities. China will seek hegemonic status over the various South East Asian nations and even ruthlessly stamping out the remnants of the vibrant democracy in Hong Kong, a democracy the Chinese government solemnly swore to respect in its treaty with Great Britain, to achieve this goal. Ultimately, Xi seeks to take over Taiwan. Appealing to the better angels of China’s nature will not alter its course; no, deterrence must rest on making clear to China that if it attacks the US or its allies, then the costs it will impose in response will be unacceptable to them.

The second misconception is that whatever Russia and China are building and the deployment of these

US nuclear deterrence policy, in the broadest sense, is virtually unchanged since the Kennedy years. America’s nuclear weapons serve to deter nuclear attacks on the US and its allies and, as a last resort, to deter major non-nuclear strategic attacks.

The second misconception is that whatever Russia and China are building and the deployment of these weapons is solely in reaction to what the US began doing first. It will be easy to dispose of this misconception. A simple glance at the last two decades will quickly demonstrate that Russia and China began modernizing and expanding their nuclear forces around 2010 when the US was only talking about the wisdom of modernizing our own aging force.

weapons is solely in reaction to what the US began doing first. It will be easy to dispose of this misconception. A simple glance at the last two decades will quickly demonstrate that Russia and China began modernizing and expanding their nuclear forces around 2010 when the US was only talking about the wisdom of modernizing our own aging force. Now, almost eleven years later, Russia and China have both deployed, placed in operational service, new ICBM, submarine-launched ballistic missiles and ballistic missile submarines (SSBN), air-launched nuclear weapons and bombers, and new non-strategic nuclear weapons. Meanwhile, the US has progressed to simply beginning to build new systems, none of which will be fielded until mid-decade at the earliest....

A third misconception is that investing in modernizing US conventional forces is far more important than investing in our nuclear forces. This contention breaks down on a number of different fault lines. First, it ignores the fundamental fact that US nuclear deterrent forces form the backdrop against which all US interactions with Russia and China take place. Whenever either leader contemplates armed aggression against the US or its allies, they must take into account that such aggression could well escalate into the use of nuclear weapons and that using nuclear weapons could destroy the regime and nation they are so keen to protect and dominate. Second, all conventional capability, and all other plans, rest on the assumption that strategic nuclear deterrence is "holding." If strategic deterrence fails, then none of the conventional force is going to operate as designed and might not work at all./ Strategic forces establish the ultimate permissive operating condition. One can consider projecting power against a nuclear-capable opponent with an acceptable risk of avoiding a nuclear retaliation, which even an unlimited conventional force cannot deter....

A fourth misconception is that we no longer need

a triad of strategic nuclear forces. The misguided missile comes in several forms. First, there is the assertion that the submarine leg of the triad and the bomber leg of the triad are sufficient for deterrence. That ignores the fact that the bomber leg of the triad doesn't currently stand alert; although it could be recalled to do so, senior Air Force officers have made clear that it could be on alert only for a very limited period of time because over the last twenty to thirty years the government neglected to procure the necessary spare parts and sustainability items need to support a prolonged alert.

Then again, until the current aging air-launched cruise missile is replaced by the long-range stand-off weapon (something also opposed by the progressives) its deterrent punch is obsolescing. The AGM-86B air-launched cruise missile was designed to defeat the Soviet air defenses of the

1980s—not the ultra-modern systems Russia deploys today. Finally, the "no triad" argument overlooks the critical role each leg plays in hedging against the possibility that

Finally, the "no triad" argument overlooks the critical role each leg plays in hedging against the possibility that a technical failure or a Russian or Chinese advance will negate (even temporarily) one of the triad legs.

a technical failure or a Russian or Chinese advance will negate (even temporarily) one of the triad legs. Take away the ICBM force and there is no adequate backup if the US has issues with either the SSBNs or with the Trident missiles they carry. The no-triad crowd also ignores the vital role our ICBM plays in complicating our enemies' target planning, a complication that contributes to deterrence.

A related and fifth misconception is that the US ICBM force is on a "hair-trigger" and that it is more dangerous to the US than it is to its adversaries. This usually begins with the spurious bogeyman. For example, a false alarm could cause a president to order a nuclear strike. To be sure, the US did experience two false alarms, one due to a chip failure and one due to human error; those occurred in 1979 and 1980. Thus, the country has not experienced a false alarm in over forty years nor does it expect to give the recent improvements to its warning systems.

A sixth misconception is that the required modernization of the US sea-based deterrent can be accomplished solely through building a minimum of twelve new Columbia-class SSBNs. The focus on the SSBNs, while necessary, ignores the fact that the Trident II missile system also requires updating and eventual replacement. The proposed W-93 warhead, just beginning concept development, is needed to rebalance the SLBM fleet and eliminate a looming and dangerous over-reliance on the W76 thermonuclear warhead.

A seventh misconception is that the US believes in fighting a nuclear war. This is one of those false ideas the disarmament community has been spreading for decades. They bolster this claim by pointing to the fact that for decades we have developed "limited options" in the event deterrence fails. No serious US policymaker in recent memory has believed that a nuclear war could be controlled. Indeed, the risk of the military using a small number of nuclear weapons, which could escalate into an all-out civilization-destroying exchange, is one of the great deterrents to any leader contemplating nuclear or conventional aggression against the US or its allies. The whole point of US nuclear policy is to prevent the outbreak of war among the major powers....

In summary, nuclear deterrence is both very difficult and relatively simple. It is "difficult" to accept that there is no guarantee adversaries of the US will avoid resorting to nuclear weapons in a crisis, especially since they repeatedly say they will. It is "simple" in the sense that having the capability at any level of nuclear force employment to match the threats of US adversaries is the best guarantee the country can have that, adversaries will not seek to use such weapons at any time in any crisis against anyone.

However, failure to fully understand the myriad

dangerous misconceptions embraced by nuclear critics might very well slide the US into policies that make securing deterrence very difficult while making it relatively simple for US adversaries to be tempted to recklessly choose to risk Armageddon in the pursuit of their totalitarian and hegemonic objectives.

Source: <https://nationalinterest.org/feature/seven-deadly-misconceptions-about-nuclear-deterrence-189430?page=0%2C1>, 10 July 2021.

NUCLEAR STRATEGY

CHINA

PLARF Goes on Missiles Silo-Building Spree

Nuclear deterrence is both very difficult and relatively simple. It is "difficult" to accept that there is no guarantee adversaries of the US will avoid resorting to nuclear weapons in a crisis, especially since they repeatedly say they will. It is "simple" in the sense that having the capability at any level of nuclear force employment to match the threats of US adversaries is the best guarantee the country can have that, adversaries will not seek to use such weapons at any time in any crisis against anyone.

One of the most ground-breaking revelations regarding China's nuclear missile arsenal was revealed in late June, indicating a pending sharp rise in ICBM in the arsenal of the People's Liberation Army Rocket Force (PLARF). The discovery of 120 under-construction underground silos presumably for DF-41 ICBMs in landlocked northwest Gansu Province was made by Decker Eveleth, an amateur

satellite intelligence analyst. He used commercially available satellite imagery from Planet to pinpoint massive amounts of military construction, and his findings on behalf of the James Martin Center for Non-Proliferation Studies in Monterey, California were published by the Washington Post.

The site of interest covers hundreds of square miles of desert to the west and southwest of Yumen town in northwest China. The missile launch facilities echo those already known to belong to the PLARF. The site is still under construction, and its scope was described by analysts as "incredible".

With major construction kicking off earlier this year, many of the sites are hidden under 70m-

wide dome-shaped inflatable covers, which is typical of Chinese missile sites under construction as they conceal activities and construction details from prying satellite eyes. For those sites without such a cover, workers can be seen excavating circular-shaped pits. There is also evidence of a command-and-control center.

The sites are located in two giant swathes, and each site is separated from the other by an average of 3km. Having them in such close proximity with centralized command-and-control facilities and access to maintenance will greatly reduce personnel and maintenance costs. Such silo clusters are different to anything previously seen in China.

Previously, for example, the PLA has had entire companies manning liquid-fueled DF-5 ICBM silos in Hunan Province's countryside. With such a distributed deployment pattern far from maintenance centers, the PLA required a large transport fleet to move fuel, missiles and other equipment backwards and forwards. Having solid-fueled DF-41 ICBMs in close proximity should allow missiles to be deployed at a lower overall cost.

The Pentagon estimates that the PLA's nuclear stockpile is in the low-200s, of which 100 warheads are on land-based ICBMs. The 2020 Pentagon report predicted that these ICBM warheads would reach 200 by 2025. If each new silo near Yumen is to eventually host a missile, this would obviously represent an enormous and historic change in China's nuclear posture. However, there is debate over whether each silo would actually host a missile, since some could be decoys. Alternatively, they could represent a

"shell game", the conman's trick of shuffling hidden objects to fool an observer. Thus, China

The sites are located in two giant swathes, and each site is separated from the other by an average of 3km. Having them in such close proximity with centralized command-and-control facilities and access to maintenance will greatly reduce personnel and maintenance costs. Such silo clusters are different to anything previously seen in China.

could randomly rotate a smaller number of ICBMs around these silos to keep an opponent guessing. If the shell game hypothesis is correct, it is still impossible to predict the exact ratio of how many silos would receive missiles; various guesses include one missile per eight silos, or even 1:16.

The USA planned such a shell game during the Cold War in order to deceive the USSR, but it does come with attendant problems such as how to move and sustain large missiles without being detected. The Carter administration planned to build a staggering 4,600 silos to protect around 200 MX/Peacekeeper ICBMs.

...With fewer support vehicles required for the latest DF-31AG and DF-41 TELs, it would be cheaper to deploy decoys too. Eveleth tweeted, "Would not surprise me if they used decoys

China could randomly rotate a smaller number of ICBMs around these silos to keep an opponent guessing. If the shell game hypothesis is correct, it is still impossible to predict the exact ratio of how many silos would receive missiles; various guesses include one missile per eight silos, or even 1:16.

combined with disguising the real TELs to improve survivability." The PLARF is known to be building at least 16 DF-41 missile silos in Jilantai in Inner Mongolia, likely a PLARF training area. Another 18 silos for the DF-5 ICBM exist, with eight more possibly under construction. Adding them

all together would give just over 160, a far cry from the 18 that had existed for so many years. Of course, a silo's disadvantage is that its position is fixed and known, so it could more easily be targeted by enemy precision-guided munitions during a conflict. This is why China has shown a recent preference for deploying truck-based launchers. Known as transporter-erector-launchers (TEL), these large wheeled vehicles can rapidly move to new locations to launch missiles. This makes them far harder to track and destroy, as they can hide from satellites and operate from

multiple potential launch sites.

What is the DF-41, the missile likely to be stationed in Gansu? It appeared officially in 2019, and 644 Brigade in Hanzhong, Shaanxi Province was the first unit issued with the ICBM for operational testing and evaluation. American officials note that China may be pursuing railway-mounted DF-41s too.

The DF-41 has an estimated range of 12,000-15,000km, and its warhead is unlikely to contain more than five or six MIRV. As well as MIRVs, the DF-41 could alternatively carry a single hypersonic glider vehicle, which uses speed to evade US missile defenses.... An important question is why is China focusing so heavily on ICBMs? It seems to stem from an extended deterrence strategy. Beijing views the USA as its strongest threat, so having 120 additional missile silos would grant a strong deterrent, as some would be able to survive a first strike in hostilities. It would ensure that China retains enough ICBMs to maintain a credible counterstrike against the USA.

China presumably does not want a nuclear arms race with the USA where it tries to match sheer weapon numbers, so multiplying silos is an alternative way of achieving a more robust level of deterrence. However, an unintended consequence is that the USA may accelerate its own nuclear modernization program. Washington DC had already announced an extensive upgrade for weapons, including a new air-launched cruise missile and at least two new types of warheads.... Indeed, China's nuclear arsenal is still greatly eclipsed by the USA's and Russia's combined total of 11,000 nuclear warheads. The USA possesses around 3,800 warheads, of which around 1,750 are deployed....

Source: <https://www.aninews.in/news/world/asia/plarf-goes-on-missile-silo-building-spree20210706173032/>, 06 July 2021.

USA

Raytheon Wins \$2B Contract for New Nuclear Cruise Missile

Raytheon Technologies will get up to \$2 billion to develop the US Air Force's Long Range Standoff Weapon (LRSO) system, a new nuclear-capable, air-launched cruise missile that will be carried by B-52 and B-21 bombers. The service on July 1 awarded Raytheon a cost-plus-fixed-fee deal for the engineering and manufacturing development stage of the LRSO program, with contract options that max out at about \$2 billion.

During the program's EMD stage, Raytheon will continue maturing its LRSO design and prepare for full-rate production of the weapon in 2027, the contract announcement stated. LRSO is slated to replace the AGM-86B air-launched cruise missile, which was designed in the 1970s. Air Force officials have argued that the legacy ALCM has become more difficult to maintain as its supply base becomes obsolete, and its effectiveness gets increasingly compromised as adversaries field more sophisticated air defense systems.

LRSO is slated to replace the AGM-86B air-launched cruise missile, which was designed in the 1970s. Air Force officials have argued that the legacy ALCM has become more difficult to maintain as its supply base becomes obsolete, and its effectiveness gets increasingly compromised as adversaries field more sophisticated air defense systems.

effectiveness gets increasingly compromised as adversaries field more sophisticated air defense systems.

The Air Force could buy more than 1,000 LRSO missiles, which are projected to have a range in excess of 1,500 miles. During a July 2 briefing, Pentagon spokesman John Kirby said the Defense Department aims to keep LRSO development on track, even as it executes a Nuclear Posture Review that could eventually call for the weapon's cancellation.

The Pentagon's fiscal 2022 budget requests full funding for the military's nuclear modernization priorities, including \$609 million for the LRSO program. That money ensures efforts like LRSO, the B-21 bomber and the Columbia-class submarine proceed, even as the department studies whether to make changes to the nuclear enterprise....

The Congressional Budget Office estimated in December 2020 that the Pentagon would save \$12.5 billion from FY21 to FY30 by cancelling the LRSO program and the W80-4 warhead it will carry. In 2017, Raytheon and Lockheed Martin each received a contract worth about \$900 million for the 54-month technology maturation and risk reduction phase of the LRSO program. At the time, the service planned to select a single vendor in FY22 during the EMD period.

However, the Air Force announced in 2020 that it would sole-source the LRSO design developed by Raytheon, effectively booting Lockheed from the competition two years early. "Our competitive TMRR phase, which included both Lockheed Martin and Raytheon as the prime contractors, enabled us to select a high-confidence design at this point in the acquisition process," Maj. Gen. Shaun Morris, who leads the Air Force Nuclear Weapons Center, said at the time.

Source: <https://www.defensenews.com/air/2021/07/06/raytheon-wins-2b-for-new-nuclear-cruise-missile/>, 07 July 2021.

USA–RUSSIA

Russia Hopes to Kick Off Strategic Stability Talks with US in July

Russia hopes to hold the opening round of nuclear strategic stability talks with the US in July, RIA news agency quoted deputy foreign minister Sergei Ryabkov as saying on June 6, 2021. US President Biden and Russian President Putin agreed at a summit in Geneva in June to embark on an integrated bilateral Strategic Stability Dialogue to lay the groundwork for future arms control and risk reduction measures.

Source: <https://www.reuters.com/world/russia->

hopes-kick-off-strategic-stability-talks-with-us-july-report-2021-07-06/, 06 July 2021.

BALLISTIC MISSILE DEFENCE

CHINA

China Interested in Developing Nuclear-Powered Drones, Cruise Missiles Like Russia's

The US. envoy to the Conference on Disarmament in Geneva hinted that China

is looking into developing so-called exotic nukes such as nuclear-powered underwater drones and cruise missiles being developed by Russia.

Ambassador Wood told the Associated Press that China so far hasn't developed or been capable of weaponizing the technology. The US. does not have either system in its arsenal. "This is something

they are looking at," Wood said. "If they were to develop...these kinds of weapons and aerial systems, this has the potential to change the strategic stability environment in a dynamic way." "This is not where

China was 10 years ago," Wood added, noting the "upward trajectory" that China has been on in the quantity and quality of its weapons systems. "They're pursuing weapons similar to some of the nuclear-powered delivery systems that the Russians have been pursuing."

Russia has said its development of such weaponry is aimed at countering the US' defenses against ballistic missiles. Moscow has expressed concern that such defenses could eventually undermine the viability of its strategic offensive nuclear forces, although Washington insists that its defensive system is designed to protect the US homeland from North Korean missiles, not Russia's or China's.

Asked about Wood's comments on China's interest in developing nuclear-powered cruise missiles and

US President Biden and Russian President Putin agreed at a summit in Geneva in June to embark on an integrated bilateral Strategic Stability Dialogue to lay the groundwork for future arms control and risk reduction measures.

The US. envoy to the Conference on Disarmament in Geneva hinted that China is looking into developing so-called exotic nukes such as nuclear-powered underwater drones and cruise missiles being developed by Russia.

underwater drones, Hans Kristensen, director of the Nuclear Information Project at the Federation of American Scientists, said he hadn't heard any US government official make a similar assertion. But "it's not surprising that China would be developing and exploring technologies they see others working on," Kristensen, an experienced analyst of Chinese, Russian and American nuclear arsenals, wrote in an email. He noted that developing weapons technology but leaving it on the shelf, rather than deploying it, "is an old trademark of the Chinese." Wood's comments are part of a broader push by the US to draw China into strategic talks. He decried a lack of transparency from Beijing and a shortage of US-China communication along the lines of that between the US and Russia—and the former Soviet Union—for decades. "Until China sits down with the US bilaterally, the risk of a devastating arms race will continue to increase—and that's in the interest of no one," he said

Source: <https://www.newsweek.com/china-interested-developing-nuclear-powered-drones-cruise-missiles-like-russias-1608060>, 08 July 2021.

SOUTH KOREA

South Korea Conducts Submarine-Launched Ballistic Missile Test

...South Korea conducted a submarine launched ballistic Missile Test which was declared a success. This paves the way to the Republic of Korea entering the "elite club" of countries able to design and field its own SLBMs. North Korea is arguably the 7th country in the world to have acquired this technology. All countries that have designed SLBMs so far are nuclear states. South Korea is notably the only country that will possess SLBMs without strategic nuclear weapons.

Details about the test are not fully open to the public, but it was reportedly conducted with a variant of Hyunmoo 2B missiles that can be fired within the range of 500 km. The ROK Navy expects to enhance strategic functions against North

Korea by taking advantage of K-SLBMs (locally known as Hyunmoo 4-4) after the Moon-Biden press conference confirmed that both countries agreed to lift the ROK-US. Missile Guidelines on May 2021.

...Since the ROK Navy reportedly conducted its SLBM test-firing from a submerged barge this time and successfully completed a land-based launch test in the end of last year, the local press has speculated that the actual launch from the first 3,000 tons submarine (from a dived position) could be executed sooner or later, as Yonhap News Agency reported....

The first ship of the Dosan Ahn Chang Ho-class is fitted with 6 cold launch VLS (vertical launch systems) reportedly capable of launching both the

Hyunmoo 4-4 SLBM and a SLCM known as Hyunmoo 3C with a range of 1,500 Km. The follow-on class, known as KSS III Batch 2, will be fitted with up to 10 of those VLS. However, the MND still has not officially confirmed exact information about the development, size, and length of SLBMs, even whether the 3,000 tons submarines would be loaded with ballistic missiles.

Source: <https://www.navalnews.com/naval-news/2021/07/south-korea-conducts-submarine-launched-ballistic-missile-test/>, 04 July 2021.

EMERGING TECHNOLOGIES AND DETERRENCE

CANADA

Cameco, GE Hitachi and Global Nuclear Fuel to Examine Potential Collaboration to Support BWRX-300 Small Modular Reactor Deployment

Cameco, GE Hitachi Nuclear Energy (GEH) and Global Nuclear Fuel-Americas (GNF-A) have entered into a Memorandum of Understanding to explore several areas of cooperation to advance the commercialization and deployment of BWRX-300 SMRs in Canada and around the world.

"Nuclear power will play a massive role in the global shift to zero-carbon energy, generating a lot of momentum for emerging SMR and advanced

The first ship of the Dosan Ahn Chang Ho-class is fitted with 6 cold launch VLS (vertical launch systems) reportedly capable of launching both the Hyunmoo 4-4 SLBM and a SLCM known as Hyunmoo 3C with a range of 1,500 Km.

reactor technologies," said Cameco president and CEO Tim Gitzel. "Cameco intends to be a go-to fuel supplier for these innovative reactors. We're looking forward to working with GEH and GNF to see what opportunities might exist around their novel SMR design." Cameco supplies uranium, uranium refining and conversion services to the nuclear industry worldwide and is a leading manufacturer of fuel assemblies and reactor components for CANDU reactors....

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 US NRC-certified ESBWR.

Through dramatic and innovative design simplification, GEH projects the BWRX-300 will require significantly less capital cost per MW when compared to other SMR designs. By leveraging the existing ESBWR design certification, utilizing the licensed and proven GNF2 fuel design, and incorporating proven components and supply chain expertise, GEH believes the BWRX-300 can become the lowest-risk, most cost-competitive and quickest to market SMR.

An independent report by PwC Canada, commissioned by GEH, estimates that the construction and operation of the first BWRX-300 in Ontario is expected to generate approximately \$2.3 billion in Gross Domestic Product (GDP), \$1.9 billion in labour income and more than \$750 million in federal, provincial and municipal tax revenue over its lifespan.

The report estimates that each subsequent BWRX-300 deployed in Ontario and other provinces is expected to further generate more than \$1.1 billion in GDP and more than \$300 million in tax revenue. This MOU is not exclusive and does not preclude GEH or Cameco from pursuing similar arrangements with other companies in the nuclear energy sector....

Source: <https://investingnews.com/news/uranium-investing/cameco-ge-hitachi-and-global-nuclear-fuel-to-examine-potential-collaboration-to-support-bwrx-300-small-modular-reactor-deployment/>, 07 July 2021.

CHINA

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 US NRC-certified ESBWR. Through dramatic and innovative design simplification, GEH projects the BWRX-300 will require significantly less capital cost per MW when compared to other SMR designs.

How Nuclear Tech Helps China's COVID-19 Battle

The need to sustainably process medical waste is attracting attention in China, since official data suggests the volume thrown away across hospitals in China amid COVID-19 stood at up to 3,000 tonnes per day. To meet the challenge, some

hospitals are using advanced technologies. In May, China's first set of equipment using electron beam, or EB, for wastewater treatment has been applied in Xiyuan Hospital in Shiyan city, central China's Hubei Province.

How Does It Work? Tsinghua University, together with China General Nuclear Power Corporation (CGN), have applied EB irradiation technology to the sterilization of medical supplies and the treatment of medical wastewater. Wang Jianlong, deputy dean of the Institute of Nuclear and New Energy Technology of Tsinghua University, told CGTN that the equipment can

Tsinghua University, together with China General Nuclear Power Corporation (CGN), have applied EB irradiation technology to the sterilization of medical supplies and the treatment of medical wastewater.

destroy the structure of viruses so as to kill them, and degrade toxic pollutants in wastewater using high-energy electron beams generated by electron accelerators. Wang believes the move

could help prevent the viruses from contaminating the environment through medical wastewater. "It can treat 400 tonnes of wastewater per day," said Liu Zhenwei, Party Committee Secretary of Xiyuan Hospital. He added that the volume of demand in his hospital was 200 tonnes during the climax of the outbreak. "So it's completely able to meet our needs."

Wide Application: Apart from wastewater disposal, EB technology is also used to kill the coronavirus on the outer packaging of frozen food.

Wang Xipo, CGN's vice general manager, said using EB radiation to kill the virus on food packages was approved by experts this March. "It is safe and environmentally friendly," Wang told CGTN, noting that the pilot project will be implemented in Shenzhen soon.

To better guide the application of nuclear technology in the health sector, China released a plan in June focusing on domestic medical isotopes, which are used by medical professionals to diagnose and treat health conditions such as heart disease and cancer.

A Healthier China: To better guide the application of nuclear technology in the health sector, China released a plan in June focusing on domestic medical isotopes, which are used by medical professionals to diagnose and treat health conditions such as heart disease and cancer. "The production of medical isotopes is now of certain capacity," Deng Ge, secretary general of China Atomic Energy Authority, told CGTN. "It is, however, small in scale, with a significant portion relying on imports. Facing the complicated international situation, independent R&D on nuclear medicine is inevitable," Deng said. Yet compared with international levels, Deng said China still needs to improve its nuclear medicine and related medical equipment, so as to further improve people's living standards and help build a healthier China.

Source: <https://news.cgtn.com/news/2021-07-10/How-nuclear-tech-helps-China-s-COVID-19-battle-11MW46MTPZC/index.html>, 10 July 2021.

INDIA

First Indigenous Alloy for Nuclear-Plants Ready

ArcelorMittal Nippon Steel India has designed and manufactured the country's first indigenously developed specialist-grade steel plates (16Mo3). They are meant for use in heavy water reactors

for the Nuclear Power Corporation of India Ltd, said a senior AM/NS official.

In line with Prime Minister Narendra Modi's 'Atmanirbhar Bharat' vision, this has been developed in collaboration with Larsen & Toubro Ltd, the official said. These special steel plates were shipped after a flagging-off ceremony at AM/NS India's Hazira steel plant on June 29. "This is the first time

that a domestic supplier has been able to meet the high raw material and manufacturing criteria laid down by NPCIL for critical-class equipment of this grade. Previously, such plates were acquired from overseas," he said. He also added: "Due to a historical lack of specialist manufacturing capability among domestic plate mills, India's nuclear programme has always imported critical alloy steel grades from Europe." 16 Mo3-grade plates are among the most critical internal components of steam generators, operating under extreme temperature, pressure and radioactive conditions.

Source: <https://timesofindia.indiatimes.com/city/ahmedabad/first-indigenous-alloy-for-n-plants-ready/articleshow/84000297.cms>, 01 July 2021.

UK

University of Liverpool Leads £1.17 Million Innovative Future MSR Reactor Project

The University of Liverpool has been awarded £1.17 million from the Engineering and Physical Sciences Research Council (EPSRC) to lead a collaborative project to explore a new, more sustainable and more economic nuclear technology for the UK. The new technology is based on Molten Salt Reactors that do not require expensive solid fuel production and a highly

complex fuel cycle. This makes them ideal for a disruptive solution for closed fuel cycle operation using an innovative approach to operate on spent nuclear fuel (currently declared as waste) that is capable of releasing up to a factor of 100 times more energy.

The project is the first step towards establishing a UK 'zero-power' experimental facility for reactor research which will be a low-cost, low-risk approach for more rapid development of new nuclear systems. It will use advanced modelling and simulation tools to produce a design for the zero-power reactor experiment for molten salt reactors. It will be supported by an experimental program to determine the thermo-physical properties of the future fuel material to improve the simulation results as well as performing social science studies.

The project, which also involves the Universities of Lancaster and Manchester and several national and international industrial partners as advisors, will be led by Professor Bruno Merk who holds the Royal Academy of Engineering Chair in Emerging Technology at the University. Professor Merk's research focuses on developing new and innovative technologies to transform the nuclear energy sector. His ultimate vision is to develop a new generation nuclear reactor, which uses waste of the more traditional reactors as their fuel to produce energy while solving the long-term nuclear waste problem.

Professor Merk said: "Even if the programme is small, this is the first big step for molten salt reactor technologies development in the UK. Zero-power reactors are traditionally the first step to open a new reactor development programme to test the technologies in a safe setting, while delivering validation for codes and first safety demonstrations for the regulator. "This innovative project will make a real contribution to the molten salt reactor design. It is a move towards a UK molten salt reactor pioneering zero-power facility that will place the UK at the forefront of molten

salt reactor demonstrator developments and will create a focal point for researchers from the world to come to UK."

Source: https://www.eurekalert.org/pub_releases/2021-07/uol-uol070721.php, 07 July 2021.

NUCLEAR ENERGY

EU

Commission to Invest €300M in Nuclear Research in 2021

The EU will invest €300 million in nuclear energy research in 2021 as part of Euratom, the EU's five-year €1.38 billion programme, with a third of the funding this year - €102 million - going to push forward nuclear fusion. Only around a fifth of the

Nuclear energy is an important strategic resource, with nuclear fission accounting for almost 26% of electricity produced in the EU. It also has the great attraction of being carbon neutral. But its safety record and the age of many nuclear plants is prompting the search for alternatives.

Euratom budget will go into fission research, leaving nuclear lobbies unhappy. "We are of course disappointed to see the low levels of funds being granted to fission R&D," said the FORATOM trade association for nuclear energy. "This is due to the

majority of the funds now being allocated to fusion."

In the next five years, there is €583 million for fusion research and development, compared to €266 million for nuclear fission, safety and radiation protection. The balance of €532 million is for research in the Commission's in-house science hub, the Joint Research Centre. Nuclear energy is an important strategic resource, with nuclear fission accounting for almost 26% of electricity produced in the EU. It also has the great attraction of being carbon neutral. But its safety record and the age of many nuclear plants is prompting the search for alternatives. After the Fukushima nuclear accident in Japan in 2011, Germany moved to phase out all nuclear energy by 2022 as a safety precaution.

The lack of funding for fission – apart from nuclear waste management and decommissioning - looks misplaced at a time when research into clean

energy technologies is critical, FORATOM believes... Some parts of the new Euratom programme are more closely tied than previously to the EU Horizon Europe research programme. One example is a call for cross-sectoral synergies and new applications of nuclear technologies....

In the first year of the five-year programme, Euratom will have 16 open calls, as well as directly funding a number of other projects, including in-house at the European Commission's Joint Research Centre. For all these calls, the participation rules are the same as for Horizon Europe.

Euratom's fusion research funding will mostly be channelled through ITER, the megaproject that is constructing a magnetic fusion device in south west France. The device is intended to prove the feasibility of fusion as a large-scale and carbon-free source of energy. Working in partnership with research and energy organisations from EU member states, Switzerland, and the UK, the Euratom funded research will help generate knowledge and provide training for fusion scientists and engineers, in preparation for ITER becoming operational by 2025, when it is foreseen to start running low power hydrogen fusion reactions.

This will be the first time the UK is involved in ITER research as a non-member of the EU. It maintains its position following the signing in December 2020 of the Nuclear Cooperation Agreement between the UK and Euratom, which is the legal entity through which Europe holds its membership in ITER. Meanwhile, Switzerland's level of involvement in cross over Euratom/Horizon Europe research, is less clear, after the European Commission said the country would not be eligible to take part in Horizon Europe.

The 16 calls are set to open for applications on 7 July, with seven focused on safety, one on harmonising the application of the international

framework in nuclear waste management and decommissioning, three calls looking into the applications of nuclear science, and five for building up competences and expertise in the field. They will largely focus on fission.

Source: <https://sciencebusiness.net/news/commission-invest-eu300m-nuclear-research-2021>, 06 July 2021.

GENERAL

A Roadmap to Net Zero

The IEA has presented what it claims as world's first comprehensive study of how to transition to a net zero energy system by 2050. The outcome should be a "clean, dynamic and resilient energy economy dominated by renewables like solar and wind instead of fossil fuels". The report also examines key uncertainties, such as the roles of bioenergy, carbon capture and behavioural changes in reaching net zero.

In his foreword to the report IEA executive director Dr Fatih Birol said the gap between rhetoric and action had to close, and "Doing so requires nothing short of a total transformation of the energy systems that underpin our economies". Noting that cheaper renewable energy technologies give electricity the edge in the race to zero, IEA says: hydropower and nuclear, "provide an essential foundation for transitions." But by 2050, almost 90% of electricity generation comes from renewable sources, with wind and solar PV together accounting for nearly 70%.

The report looks at CO2 emissions and energy supply and use, based on scenarios. The Stated Policies Scenario (STEPS) takes account of specific policies and the Announced Pledges Case (APC), assumes that all announced national net zero pledges are achieved in full and on time, with or without specific policies. The Net-Zero Emissions by 2050 Scenario (NZE) describes how energy

Noting that cheaper renewable energy technologies give electricity the edge in the race to zero, IEA says: hydropower and nuclear, "provide an essential foundation for transitions." But by 2050, almost 90% of electricity generation comes from renewable sources, with wind and solar PV together accounting for nearly 70%.

demand and the energy mix have to evolve and examines the implications and the major milestones on the way. With respect to nuclear, IEA says that under STEPS, nuclear energy grows by 15% between 2020 and 2030, mainly reflecting expansions in China. Under APC nuclear power increases steadily, maintaining its global market share of about 10%, led by increases in China”.

The Net-Zero Emissions by 2050 Scenario (NZE) describes how energy demand and the energy mix have to evolve and examines the implications and the major milestones on the way. With respect to nuclear, IEA says that under STEPS, nuclear energy grows by 15% between 2020 and 2030, mainly reflecting expansions in China. Under APC nuclear power increases steadily, maintaining its global market share of about 10%, led by increases in China”.

The energy mix in 2050 in the NZE is much more diverse than today, IEA says. Renewables provide two-thirds of energy use, including bioenergy, wind, solar, hydroelectricity and geothermal. “There is also a large increase in energy supply from nuclear power, which nearly doubles between 2020 and 2050.”

An increasing share of hydrogen production comes from electrolysers. “Electrolysers are powered by grid electricity, dedicated renewables in regions with excellent renewable resources and other low-carbon sources such as nuclear power,” says the report. It says that by 2050, hydrogen production in the NZE is almost entirely based on low-carbon technologies. “Electrolysis absorbs close to 15000TWh, or 20% of global electricity supply in 2050, largely from renewable resources (95%), but also from nuclear power (3%) and fossil fuels with CCUS (2%).” IEA says nuclear power makes a significant contribution. In the electricity sector in the NZE, “its output rising steadily by 40% to 2030 and doubling by 2050, though its overall share of generation is below 10% in 2050”.

At its peak in the early 2030s, global nuclear capacity additions reach 30GW a year, five-times the rate of the previous decade. In advanced economies, lifetime extensions for existing

reactors are pursued in many countries, while new construction expands to about 4.5GW a year on average from 2021 to 2035, with increasing emphasis on small modular reactors...

From 2011 to 2020, an average of 6GW of new nuclear capacity came online each year. By 2030, this increases to 24GW a year in the NZE. ...The World Nuclear Association said the IEA's NZE scenario “puts too much faith in technologies that are uncertain, untested, or

unreliable and fails to reflect both the size and scope of the contribution nuclear technologies could make”. It adds, “Given that more than 60% of the world's electricity is currently generated by fossil fuels, if we are to eliminate them in less

than 30 years, the IEA's assessment of the role of nuclear is highly impractical.” WNA notes that, in addition to electricity, nuclear energy can generate zero-carbon heat....

IEA says nuclear power makes a significant contribution. In the electricity sector in the NZE, “its output rising steadily by 40% to 2030 and doubling by 2050, though its overall share of generation is below 10% in 2050”.

Source: <https://www.neimagazine.com/features/featurea-roadmap-to-net-zero-8861039/>, 30 June 2021.

INDIA

First Concrete for Kudankulam 5

First concrete was poured on 29 June to mark the start of construction of unit 5 at India's Kudankulam NPP, being built by Russia's Rosatom. Due to anti-Covid restrictions, the ceremony was held via video-conference. This signalled the official start of the third stage of the plant. Kudankulam is being built under a 1988 Russian-Indian agreement which was amended in 1998.

The general contractor is Atomstroyexport, the general designer is Atomenergoproekt.

Kudankulam is one of the largest nuclear power projects in India and is scheduled to have six Russian VVER-1000 reactors. Kudankulam 1 and 2 (stage 1) are in operation, units 3 and 4 (stage 2) are under construction and units 5 and 6 will comprise stage 3. The laying of the first concrete was preceded by extensive preliminary work: concrete preparation for the foundations of the reactor building, an auxiliary reactor building with a control unit, a turbine building and a building for normal operation power supply, emergency power supply and control safety systems....

In December 2014, both sides announced a decision for the construction of at least 12 more units in India. Russian enterprises are already manufacturing the equipment required for the primary installation, the equipment of the reactor plant and the turbine hall for unit 5. Already on July 1, the construction horizon of up to two years, the construction is provided with working documentation. Units 3-6 are being built according to the NPP-92 project with a VVER-1000 (V-412) reactor plants.

Source: <https://www.neimagazine.com/news/newsfirst-concrete-for-kudankulam-5-8862554>, 01 July 2021.

India Designs Special Steel Plates for NPCIL

ArcelorMittal Nippon Steel India has designed and manufactured India's first indigenously developed specialist-grade steel plates (16Mo3) for use in NPCIL's heavy water reactors. These special steel plates were shipped after a ceremony at AM/NS India's Hazira steel plant on 29 June. In line with Prime Minister Narendra Modi's 'Atmanirbhar Bharat' vision, the plates had been developed in collaboration with Larsen & Toubro Ltd...The 16Mo3-grade plates are among the most critical internal components of steam generators,

operating under extreme temperature, pressure and radioactive conditions.

Source: <https://www.neimagazine.com/news/newsindia-designs-special-steel-plates-for-npcil-8869516>, 06 July 2021.

NETHERLANDS

Dutch Study Finds Commercial Support for Nuclear New Build

A motion was adopted in the House of Representatives on 17 September 2020 in response to a motion by Klaas Dijkhoff - former leader of the People's Party for Freedom and Democracy - who asked the cabinet to investigate the conditions under which market parties are prepared to invest in nuclear power plants in the Netherlands, what public support is required for this, and in which regions there would be interest in hosting a nuclear power plant. The Ministry of Economic Affairs and Climate Policy subsequently asked KPMG to conduct a market consultation on nuclear energy in the Netherlands.

KPGM began work on the study on 8 February this year. It interviewed 41 national and international market participants, including contractors, core technology suppliers, operators, decommissioning specialists and financiers. Interviews were also conducted with 14 Dutch regions. Publicly-available information sources were also consulted.

Proven technology preferred

The consultation found most of the potentially involved companies emphasised the importance of choosing a proven reactor technology that meets applicable safety requirements. SMRs are seen as an interesting option, but these are not yet commercially available. An SMR based on a

The general contractor is Atomstroyexport, the general designer is Atomenergoproekt. Kudankulam is one of the largest nuclear power projects in India and is scheduled to have six Russian VVER-1000 reactors. Kudankulam 1 and 2 (stage 1) are in operation, units 3 and 4 (stage 2) are under construction and units 5 and 6 will comprise stage 3.

ArcelorMittal Nippon Steel India has designed and manufactured India's first indigenously developed specialist-grade steel plates (16Mo3) for use in NPCIL's heavy water reactors.

generation III+ reactor design is expected to take about 10 years to licence and build, but a proven design will only become available in 2027-2035 at the earliest, the study found.

The market participants said Generation IV reactors have potential benefits in terms of safety and/or waste, but are not expected to be commercialised until after 2040, as a result of which they will come to market too late to achieve the 2050 climate target. Market parties therefore indicated broadly that the Netherlands should opt for a Generation III+ reactor now and in due course for a Generation IV reactor once the technology has been proven.

The study found that market participants consider stable government policy with regards to nuclear energy a pre-condition for nuclear new build. They said the substantial financing size, substantial risks and lead time mean government involvement seems inevitable. This could be by providing guarantees to financing risks.

KPMG found that provincial authorities in the province of Zeeland - where the country's only operating nuclear power plant, Borssele, is located - were in favour of another plant being built. In addition, the province of Noord-Brabant said the construction of a plant there would be negotiable under certain conditions.

Furthermore, there was wide support for the Borssele plant, whose 485 MWe (net) pressurised water reactor is currently scheduled to shut down in 2033, to be kept online longer as it is economically profitable and nuclear knowledge would be preserved. However, it still needs to be investigated what investments will be required for this....

Nuclear power currently has a small role in the Dutch electricity supply, with the Borssele plant -

which began operating in 1973 - providing about 3% of total generation. In 2020, EPZ - operator of the Borssele nuclear power plant - called for an extension to its operation beyond 2033 and/or the construction of two new

large reactors at the site in order to help the Netherlands meet its energy and climate goals.

Source: <https://www.world-nuclear-news.org/Articles/Dutch-study-finds-commercial-support-for-nuclear-n>, 08 July 2021.

SOUTH AFRICA

Nuclear as a Solution for Energy Security in South Africa

The discussion around what a true 'just transition' toward clean energy looks like for South Africa is always a multi-faceted topic. A lot has been said

about renewable energy, but where does nuclear energy possibly fit into the picture, especially for South Africa. Over the last decade, South Africa's "just transition" toward clean energy has put the country's economy at considerable risk by depriving it of energy security, an effective transition from

coal, and industrial growth.

South Africa has not met its Paris Agreement decarbonisation goals and, for consecutive years, has been recording an increase in carbon intensity. To meet these goals, South Africa needs to cut its CO₂ emissions by 60% to 70% by 2050, which could deindustrialise our economy, if we continue getting it wrong.

Forecast Challenges in South Africa's Energy Future: Due to South Africa's ageing generation assets, we will see a rapid decline in coal-fired

The market participants said Generation IV reactors have potential benefits in terms of safety and/or waste, but are not expected to be commercialised until after 2040, as a result of which they will come to market too late to achieve the 2050 climate target.

The study found that market participants consider stable government policy with regards to nuclear energy a pre-condition for nuclear new build. They said the substantial financing size, substantial risks and lead time mean government involvement seems inevitable. This could be by providing guarantees to financing risks.

power generation in our energy mix over the next decade, with the possibility of only ten gigawatts running by 2050. "Clean coal" could extend its participation in our energy mix but, like most technologies working outside their comfort zones, it could price itself out of the market.

Similarly, the high volumes of toxic waste being generated by renewable energies globally is putting pressure on the industry to recycle the waste, instead of just putting it into landfill sites. Should these decommissioning and waste management costs be included into their energy production costs, as nuclear energy does, we could also speculate renewables eventually pricing itself out of the market.

South Africa's coal power decommissioning programme could reduce our generating capacity by between 1 and 1.5 gigawatts of baseload capacity per year over the next two decades. Eskom's declining Energy Availability Factor (EAF) has already started that trend. The DMRE's Integrated Resource Plan (IRP 2019) does not adequately address the replacement of baseload coal power, at a pace and scale for which we should be planning. Therefore, beyond 2030, South Africa could be chronically load shedding unless a workable energy transition is found.

A transition to a more decarbonised energy future is possible through a balanced portfolio of energy solutions which deliver energy security, access to affordable baseload energy, environmental sustainability, and economic development (jobs), as its key criteria. The generation technologies we have at our disposal together can achieve this. Nuclear energy as a solution to the future energy woes of South Africa. Nuclear energy is the only technology that delivers all these criteria and

therefore should feature significantly in South Africa's clean energy transition. Some technologies can be made cleaner and more reliable with add-

on technologies, but these additional costs tend to raise their cost per kWh or their overall CO₂ emissions. Eskom should no longer subsidise these technologies.

Had we followed through with the 2007 9.6GW nuclear procurement programme, we would have had an additional 5,000MW

of clean baseload energy on the grid producing 40TWh of electricity per year, which would have doubled again over the next five years. This would have mitigated load shedding and brought us a lot closer to our decarbonising targets. The only way to successfully replace our retired coal fleet, and achieve our sustainability objectives, is with clean baseload power like large-scale hydro or nuclear energy. As we have seen since 2007, once

you have broken your baseload foundation, it is nearly impossible to fix, unless one reduces demand through economic slowdown, which load shedding ultimately does.

Nuclear energy is easily funded through innovative and competitive financing structures. SMRs are receiving significant global attention and investment, making nuclear energy a great catalyst to kickstart our post-COVID-19 economy. Our retired coal power plant sites would be ideal locations for SMRs. Their valuable infrastructures, including the local skilled resources that can be upskilled and re-employed, will reduce costs, and revitalise a local community. By-products like process heat and green hydrogen can also add to the local economy.

South Africa's renewable energy, gas to power and embedded generation programs, can also play a vital role in balancing our energy portfolio through distributed power systems at our load centres and

Nuclear energy is the only technology that delivers all these criteria and therefore should feature significantly in South Africa's clean energy transition. Some technologies can be made cleaner and more reliable with add-on technologies, but these additional costs tend to raise their cost per kWh or their overall CO₂ emissions. Eskom should no longer subsidise these technologies.

South Africa's coal power decommissioning programme could reduce our generating capacity by between 1 and 1.5 gigawatts of baseload capacity per year over the next two decades.

beyond the grid. Environmental purists are also finding gas generation at 490g/kWh as unacceptable, leaving renewables (without batteries), hydro and nuclear energy as the leading low-carbon technologies. The Risk Mitigation Independent Power Producer Programme (RMIPPP) could have also considered upgrading our expensive, high-emissions Diesel Peakers to Combined Cycle Gas Turbines (CCGT), fueled with cheaper and cleaner Liquefied Natural Gas (LNG). This would have been an investment in our existing Eskom and IPP assets by effectively raising their capacity from 10%+ to 40%+, providing an abundance of dispatchable power on demand. LNG could also become a domestic fuel supply in the future....

Source: <https://www.esi-africa.com/industry-sectors/generation/op-ed-nuclear-as-a-solution-for-energy-security-in-south-africa/>, 08 July 2021.

SOUTH KOREA

Nuclear Safety Watchdog Approves Operation of New Nuclear Plant

The Nuclear Safety and Security Commission of South Korea on June 9 gave a conditional approval for the operation of a new nuclear power plant, after one year of its completion.... The approval has been given for the 1,400-megawatt Shin-Hanul No 1, located in the coastal county of Uljin. Yonhap reported the reactor was completed in April but has been non-functional amid a drawn-out safety review, which had started in November 2020.

The South Korean government ramped up its scrutiny regarding the safety of atomic reactors as it aims to reduce the country's dependency on nuclear energy. The need for the system to strengthen the safety measures comes in the backdrop of hydrogen explosions reported during Japan's Fukushima nuclear power plant in 2011.

The nuclear safety watchdog's review has looked into an array of safety issues, including the

plant's passive autocatalytic recombiner (PAR), which is designed to prevent hydrogen explosions, Yonhap further said, adding Shin-Hanul's PAR system faced intense scrutiny after environmental groups pointed out that its effectiveness was exaggerated. However, Korea Hydro & Nuclear Power Corp, which created the plant, said that there was no problem with the system. The South Korean government plans to reduce nuclear energy to account for 23.9 per cent of the total power generation by 2030 from around 30 per cent in 2020.

According to the Korea Hydro & Nuclear Power Corp, South Korea has 24 nuclear power plants of which 16 are operational, with seven undergoing maintenances. The country is expected to have 28 nuclear reactors by 2022.

According to the Korea Hydro & Nuclear Power Corp, South Korea has 24 nuclear power plants of which 16 are operational, with seven undergoing maintenances. The country is expected to have 28 nuclear reactors by 2022.

Source: <https://www.hindustantimes.com/science/south-korea-nuclear-safety-watchdog-approves-operation-of-new-nuclear-plant-101625905239362.html>, 10 July 2021.

UK

UK Parliamentary Group Urges Nuclear New Build

The UK urgently needs to restore nuclear capacity to at least 10GWe Net Zero, according to the All-Party Parliamentary Group on Nuclear Energy (APPG) in a position paper published on 30 June – "Net Zero Needs Nuclear: A Roadmap to 2024". The APPG, established in July 2015, provides a forum for UK parliamentarians to engage with businesses and organisations working to enable the UK to meet its decarbonisation targets through the implementation of civil nuclear projects, and to discuss policy options to support these.

APPG says the UK needs to take decisions urgently in this Parliament to restore nuclear capacity to at least 10 GWe with deployable technologies, by the early 2030s...The government must begin legislating for a financing model for new nuclear in 2021, and should identify and support the specific projects that can deliver new capacity.

Alongside this, the industry must continue its work to reduce costs on new projects at least 30% by 2030, in line with existing commitments.

The paper says the nuclear industry is ideally placed to support the government's goals of levelling up the UK economy and cutting emissions - 78% by 2035, hitting net zero in 2050. However immediate action is required with seven Advanced Gas-Cooled Reactor (AGR) power stations reaching the end of their design lives...

The government must begin legislating for a financing model for new nuclear in 2021, and should identify and support the specific projects that can deliver new capacity. Alongside this, the industry must continue its work to reduce costs on new projects at least 30% by 2030, in line with existing commitments.

Without nuclear replacement, industry and consumer costs will increase from peaking fossil fuel generation and imported power to cover gaps. System costs will also increase from loss of grid inertia provided by nuclear. The loss of all AGR fuel demand at Springfields, designated as of "strategic national importance", will lead to capability loss without new nuclear projects. Loss of reactor engineering expertise will hamper future new build projects. Energy security and grid stability will both be compromised....

Source: <https://www.neimagazine.com/news/newsuk-parliamentary-group-urges-nuclear-new-build-8862440>, 01 July 2021.

Nuclear Energy Faces Hurdles to be Included in Clean Energy Investments

Nuclear energy has been excluded from the UK government's Green Financing Framework, while several EU Member States have written to the European Commission to oppose nuclear's inclusion in the bloc's green taxonomy.

The UK's Green Financing Framework describes how the government plans to finance expenditures through the issuance of green gilts and the retail Green Savings Bonds that it says will be critical

in tackling climate change and other environmental challenges. The framework, which was produced and published on July 1 by the Treasury, sets out the basis for identification, selection, verification and reporting of the green projects that are eligible for such financing.

Under 'exclusions', the document says: "Recognising that many sustainable investors have exclusionary criteria in place around nuclear energy, the UK government will not finance any nuclear

energy-related expenditures under the Framework." It adds: "The UK government, however, recognises that reaching net zero emissions will require all energy to be delivered to consumers in zero-carbon forms and be derived from low-carbon sources. Nuclear power is, and will continue to be, a key part of the UK's low-carbon energy mix alongside solar and wind generation and carbon capture and storage. All these technologies are important in tackling climate change and diversifying the UK's supply, contributing to the UK's energy security and sustainable growth."

The UK's Green Financing Framework describes how the government plans to finance expenditures through the issuance of green gilts and the retail Green Savings Bonds that it says will be critical in tackling climate change and other environmental challenges.

The Framework aligns with the 2021 International Capital Market Association Green Bond Principles. "To enable investors to follow the progress and positive impact delivered," the Treasury said it intends to publish an allocation report on its Eligible Green Expenditures on an annual basis and an impact report setting out the environmental impacts and social benefits at least biennially.

The UK is also in the process of developing its own 'green taxonomy'. Meanwhile, a group of five EU Member States, led by Germany, have written to the European Commission asking for nuclear energy to remain excluded from the EU Taxonomy on Sustainable Finance. Their letter follows the

assessment of the Joint Research Centre (JRC), whose mission is to support EU policies with independent evidence throughout the whole policy cycle, that nuclear energy does no more harm to human health or the environment than any other power-producing technology considered to be sustainable. The letter - signed by the environment or energy ministers of Austria, Denmark, Germany, Luxembourg and Spain - points to "shortcomings" in the JRC report, which was published in April.

The ministers said the JRC's conclusion was "a misconception" and based on "two grave methodological shortcomings". The JRC "neglects to address the residual nuclear risk, assessing only the normal operation of nuclear power plants" and "disregards the life-cycle approach", according to the ministers....

Source: <https://www.world-nuclear-news.org/Articles/UK-excludes-nuclear-from-green-taxonomy?feed=feed>, 02 July 2021.

NUCLEAR COOPERATION

FRANCE-UAE

ENEC, EDF Announce Nuclear R&D Cooperation Plans

Ahmed Al Mazrouei, ENEC vice president of R&D, and Laurent Clement, CEO of EDF Middle East, signed a Letter of Intent to develop the MoU at the two-day UAE-France E-FUSION nuclear cooperation event in Dubai.

The collaboration is part of ENEC's commitment to progressing the UAE's nuclear energy industry, supporting innovation, clean electricity production and tackling climate change, the Emirati company said. "The planned MoU will elevate the strategic partnership between the two entities through sharing global expertise and the latest advancements in the nuclear energy sector, as well as exploring the production of green hydrogen powered by carbon-free nuclear energy" it added....

The first of four Korean-designed APR-1400 pressurised water reactor units at ENEC's Barakah nuclear power plant started commercial operations in 2021. Fuel loading has been completed at unit 2, which is preparing for start-up, while units 3 and 4 are in the final stages of construction and are, respectively, 94% and 89% complete. The annual E-FUSION (Emirati French Industrial Supply Chain Initiative for Nuclear) event was launched by ENEC, EDF and GIFEN (French Nuclear Cluster) in 2019, aiming to develop new Franco-Emirati commercial relations in the nuclear sector.

Source: <https://world-nuclear-news.org/Articles/ENEC-EDF-announce-nuclear-R-D-cooperation-plans>, 30 June 2021.

INDIA-RUSSIA

Academic Access to Russia's Nuclear Expertise Deepens India-Russia Bilateral Cooperation

While the bilateral ties with Russia constitute an integral cornerstone of India's foreign policy, the strategic alliance between the two countries is rooted in history, reciprocity, and amicable partnership. Among other areas of strategic co-operation, civil nuclear energy has traditionally been regarded as the crucial pillar of India-Russia bilateral partnership, exceedingly over 3 decades. Also, the year 2021 commemorates the 73rd anniversary of diplomatic relations between India and Russia.

India's three staged civil nuclear energy program is a reflection of the country's economic and scientific advancements. Since then, India has made significant strides in the field of nuclear energy. Globally, the Russian nuclear industry is perceived as an undisputed leader in advanced nuclear technology, offering cutting-edge engineering and design solutions in the domain of advanced nuclear reactors and nuclear fuel manufacturing. Subsequently, India's time-tested diplomatic co-operation with Russia over the years

positions Russia to emerge as an ideal partner to further India's civil nuclear energy program.

India-Russia Nuclear Energy Cooperation:

Furthermore, In India, Russian State Atomic Energy Corporation Rosatom is constructing six units of nuclear reactors at the Kudankulam site in Tamil Nadu with an installed capacity of 1,000 MW each. The Kudankulam Nuclear Power Plant is one of the largest nuclear power stations in India and the first 2 units are already generating GWs into the national power grid. While the construction of Units 3 and 4 is underway, the Strategic Vision adopted in December 2014 is strengthening cooperation in the peaceful use of atomic energy between Russia and India.

In India, Russian State Atomic Energy Corporation Rosatom is constructing six units of nuclear reactors at the Kudankulam site in Tamil Nadu with an installed capacity of 1,000 MW each. The Kudankulam Nuclear Power Plant is one of the largest nuclear power stations in India and the first 2 units are already generating GWs into the national power grid.

The growing partnership in the nuclear power sector between India and Russia has opened opportunities for developing advanced nuclear manufacturing capabilities in India in line with India's "Make in India" initiative. For India, local manufacturing of critical components and equipment for upcoming Russian-designed nuclear power projects is a step towards furthering India's comprehensive Atmanirbhar Bharat vision. To further strengthen India's nuclear energy prospects on Indian soil, India must pursue comprehensive technology transfer and information exchange agreements with Russia.

Academic access to Russia's Nuclear Energy Advances:

In Russia, the growth of the nuclear industry is regarded as a top national priority, thereby enabling Russia to emerge as an undisputed leader in the advanced nuclear technology industry. Today, the India-Russia nuclear energy co-operation extends to academic

level. In addition to job creation and economic incentives, young Indians now have access to Russian nuclear education, broadening academic and domain expertise of aspiring stakeholders of the nuclear energy sector. Subsequently, attracting a new generation of highly skilled and educated personnel in the field of nuclear energy.

Owing to bursaries offered by the Russian government, it is now possible to Indian students to obtain a Bachelor and master's degrees in nuclear engineering with no academic fees. Students may benefit from subsidized housing, library grants, and hands-on training at a Russian nuclear power plant.

For aspiring candidates, the available academic programs range from nuclear technologies, nuclear power engineering, thermal physics, nuclear reactors and materials, Nuclear Power Plants: Design, Operation and Engineering; as well as Materials Technology, Informatics and Computer Technology, Chemistry, Physics and Astronomy, Electrical and Heat Engineering.

Empowering Future Stakeholders of Nuclear Sector, Globally:

Russia being at the forefront of nuclear energy advancements, it bears the responsibility to guide and educate future generations in order to further encourage nuclear energy innovation. To that effect, Russia follows a streamlined enrollment process for aspiring students, While the instructors use diverse pedagogies in addition to numerous practical and research possibilities.

Also, Six Nobel laureates have contributed to the teaching curriculum and research at the Moscow Engineering Physics Institute (MEPhI), a leading Russian university established in 1942. The university works under the European Bologna

education process, and offers BS, MS, and PhD programs.

Every year, over 6,000 Indian students come to Russia to study. Although not many of them study in Moscow, a diverse multicultural community fosters exchange of ideas and culture. Nuclear engineering students from 79 countries study in Russia and their number exceeds 1,500. Students specialized in NPP receive training in NPPs operations, along with regular workshops on full-scale simulators, and at real NPPs, to fully prepare the students to work at the NPP.

With over 75-years of established track record, Russia has amassed a repository of experience and acquired extensive competencies in designing and executing cross-border large-scale nuclear projects. The two countries have identified several new areas of cooperation, academic access to Indians in Russia's nuclear energy expertise relatively being a newer dimension of India-Russia collaboration....

Source: <https://www.financialexpress.com/defence/academic-access-to-russias-nuclear-expertise-deepens-india-russia-bilateral-cooperation/2287649/>, 10 July 2021.

USA

American Nuclear Society Cautions Congress Against China Ban

The American Nuclear Society (ANS) urged Congress to oppose any amendment to H.R. 3524 – Ensuring American Global Leadership and Engagement Act – that bans US-China nuclear energy cooperation... “On behalf of the 10,000 members of the American Nuclear Society (ANS), we request that you oppose any amendments to H.R. 3524 that would cut off US–China nuclear energy cooperation,” wrote ANS CEO and Executive Director Craig Piercy in a June 30 letter to HFAC Chairman Rep. Gregory Meeks (D-NY) and Ranking Member Rep. Michael McCaul (R-TX).

ANS cautioned against a blanket ban on US-China nuclear cooperation as the embargo would undermine global nuclear safety standards and inflict significant harm to the US nuclear energy industry and supply chain – without providing any benefits....

Proposed moves to ban any US-China nuclear cooperation include recent legislation passed by the Senate, S.1260 – Endless Frontiers Act, which contains a provision (Section 2515) that restricts the US government's ability to work on or agree to any nuclear cooperation activities with China or with any company owned by the Chinese government.

ANS reminded committee members that the 2018 US Policy Framework on Civil Nuclear Cooperation with China already precludes technology transfers related to small modular reactors, advanced reactors and other nuclear technologies not transferred prior to 2018.

ANS cautioned against a blanket ban on US-China nuclear cooperation as the embargo would undermine global nuclear safety standards and inflict significant harm to the US nuclear energy industry and supply chain – without providing any benefits.

Source: <https://www.ans.org/news/article-3033/american-nuclear-society-cautions-congress-against-china-ban/>, 01 July 2021.

NUCLEAR PROLIFERATION

IRAN

Iran Gives Notice to UN Nuclear Watchdog of Making Enriched Uranium Metal

Iran has begun the process of producing enriched uranium metal, the U.N. atomic watchdog said on Tuesday, a move that could help it develop a nuclear weapon and that three European powers said threatened talks to revive the 2015 Iran nuclear deal. Iran's steps, which were disclosed by the International Atomic Energy Agency and which Tehran said were aimed at developing fuel for a research reactor, also drew criticism from the US, which called them an “unfortunate step backwards.”

US and European officials made clear that Iran's

decision would complicate, and potentially torpedo, indirect US-Iranian talks seeking to bring both nations back into compliance with the 2015 deal, which was abandoned by former US President Trump. The deal imposed curbs on Iran's nuclear programme to make it harder for Tehran to develop fissile material for nuclear weapons in return for the lifting of economic sanctions. After Trump withdrew, Iran began violating many of its restrictions. Tehran has already produced a small amount of uranium metal this year that was not enriched. That is a breach of the deal, which bans all work on uranium metal since it can be used to make the core of a nuclear bomb.

"Today, Iran informed the Agency that UO2 enriched up to 20% U-235 would be shipped to the R&D laboratory at the Fuel Fabrication Plant in Esfahan, where it would be converted to UF4 (uranium tetrafluoride) and then to uranium metal enriched to 20% U-235, before using it to manufacture the fuel," an IAEA statement said...

Source: <https://www.ndtv.com/world-news/iran-gives-notice-to-un-nuclear-watchdog-of-making-enriched-uranium-metal-2480882>, 07 July 2021.

SAUDI ARABIA

Saudi Arabia accused of developing secret nuclear weapons programme as inspectors blocked

Saudi Arabia has been accused of running a secret nuclear programme, with its regional rival Iran accusing it of blocking inspections by the global atomic watchdog. Gharibabadi, the Iranian ambassador to Vienna-based international organisations, alleged on July 8 that there was a "covert nuclear weapons programme in the

country" and called on the IAEA to brief its members on developments.

He warned that Saudi Arabia would be able to hide some of its nuclear activity if inspections continued to be prevented from investigating.

"The IAEA is not being provided with even minimum necessary verification authorities," he said, going on to accuse the kingdom of destabilising activities in the region.

Saudi Arabia is officially a non-nuclear weapon state and a signatory to the nuclear Non-Proliferation Treaty, an international accord which aims to prevent the spread of atomic weapons and technology across the world. But fears that it is developing such weapons in secret

have been heightened by Iran accusing Riyadh of refusing "to abide by its commitments to the agency's inspections, despite repetitive calls".

Saudi Arabia is widely believed to have helped fund Pakistan's nuclear bomb project since 1974, with agreements between the two nations on the provision of weapons and technology. In 2006, German magazine Cicero published satellite photographs allegedly showing an underground city with nuclear missiles in al-Sulayil, south of the capital Riyadh. In 2018, Saudi Crown Prince Mohammad bin Salman said that the kingdom would consider setting up a nuclear weapons programme if Iran succeeded in developing an atomic bomb.

The Saudi regime insists that its interest in uranium enrichment is aimed at the development of atomic energy and the construction its first research reactor began in 2020. But experts have raised doubts, given that, in solar power, the country has a cheaper and safer source of

US and European officials made clear that Iran's decision would complicate, and potentially torpedo, indirect US-Iranian talks seeking to bring both nations back into compliance with the 2015 deal, which was abandoned by former US President Trump.

Saudi Arabia is officially a non-nuclear weapon state and a signatory to the nuclear Non-Proliferation Treaty, an international accord which aims to prevent the spread of atomic weapons and technology across the world. But fears that it is developing such weapons in secret have been heightened by Iran accusing Riyadh of refusing "to abide by its commitments to the agency's inspections, despite repetitive calls".

alternative energy. Last September, Riyadh was believed to have enough uranium ore reserves to develop 90,000 tonnes of uranium, amid reports of the regime showing “an aggressive interest in developing an atomic weapons programme.”

Discussions have taken place with the IAEA regarding the Additional Protocol, which provides for tougher checks including snap inspections. The watchdog said that it was essential for the Saudi government to sign up to the additional monitoring to address weaknesses in its safeguarding system.

Source: <https://morningstaronline.co.uk/article/w/saudi-arabia-accused-developing-secret-nuclear-weapons-programme-inspectors-blocked>, 09 July 2021.

NUCLEAR DISARMAMENT

GERMANY–SPAIN–SWEDEN

‘End Nuclear Weapons Testing’

Germany is joining 15 other countries for a nuclear disarmament conference aiming to build momentum after a US-Russia summit renewed hopes for more arms control between the two nuclear powers. German Foreign Minister Maas said ahead of a nuclear arms control conference on Monday that the threat of a nuclear arms race grows “where tension and mistrust predominate.” “More than ever, we need steps that encourage trust through verifiable agreements created between nuclear-weapons states,” Maas said before departing to Madrid for a meeting of the Stockholm Initiative, which brings together 16 countries advocating global nuclear arms reduction.

The conference follows US President Biden and Russian President Putin summit in Geneva in June where they pledged to start talks on arms control. A statement after the summit said the US and Russia “seek to lay the groundwork for future arms control and risk reduction measures.” “We need to build on this with clear steps by nuclear weapons states to fulfill their responsibility and obligations on disarmament,” Maas said, adding that the Geneva summit shows how progress is possible.

New Iran Deal Soon? Maas also said June 5, 2021 he expected to save the 2015 nuclear accord with Iran “in the coming weeks”. The negotiations aim to save the deal — known to diplomats as the JCPOA — have been taking place between Iran and the five permanent UN Security Council member states plus Germany, the parties who originally brokered it. Under the Trump presidency, the US walked away from the accords designed to prevent Iran from developing a nuclear weapon.

An End to Nuclear Testing ‘Once and for All’: A joint guest commentary written by Maas, Spanish Foreign Minister Laya, and Swedish Foreign Minister Linde listed several steps nuclear-weapons countries could take toward disarmament. “This could include downgrading the role of nuclear weapons in strategies and doctrines, reducing the risk of conflict and an accidental nuclear weapon deployment, further reducing nuclear stockpiles and laying the foundations for a new generation of arms control agreements,” the foreign ministers said....

What is the Status of Global Nuclear Arms Control? In February, the US and Russia agreed to extend the New START disarmament treaty. It limits the nuclear arsenals of both countries to 800 launchers and 1,550 ready-to-use nuclear warheads each. The New START treaty is the only major arms control treaty in place between the US and Russia after the US withdrew from the Open Skies Treaty in May citing Russian non-compliance.

At the beginning of 2021, the US, Russia, the UK, France, China, India, Pakistan, Israel and North Korea possessed a total of 13,080 nuclear warheads, a decrease of 320 from the previous year, according to the Stockholm Peace Research Institute SIPRI annual report published in June. However, SIPRI researchers say the report shows worrying trends regarding global nuclear arsenals....

Source: <https://www.dw.com/en/germany-spain-and-sweden-end-nuclear-weapons-testing/a-58158956>, 07 June 2021.

GENERAL

1st UN Nuke Ban Meeting to Discuss Disarmament Period with 10 Years Eyed

Parties to a U.N. treaty prohibiting nuclear weapons are expected to discuss a deadline for complete nuclear disarmament, starting with a 10-year period at their first meeting set to be held in January 2022, the conference's president-designate said. Alexander Kmentt, director of the department for disarmament issues in the Austrian Foreign Ministry, told Kyodo News in an interview on June 5 that the deadline to be discussed as part of the Treaty on the Prohibition of nuclear weapons aims to stop nuclear-armed states from expanding their stockpiles, and strengthen pressure from the international community.

The treaty, the first international pact outlawing the development, testing, possession and use of nuclear weapons, came into effect in January 2021 with the support of many non-nuclear states. But the US, Russia and other nuclear-armed states have declined to sign the pact and are not expected to participate in the first meeting next year....

The US and Russia, which possess around 5,550 and 6,255 nuclear warheads, respectively, account for around 90 percent of the world's nuclear weapons stockpiles. Recognizing the efforts that the two countries have already made to reduce their arsenals, Kmentt said that while total disarmament itself is possible in 10 years, verification would take more time.

The treaty stipulates that an international authority or authorities should be established to verify countries have eliminated their nuclear weapons. When asked whether the International Atomic Energy Agency could play a role, Kmentt said it is "too early to talk about who...should." He stressed that a decision need not be made at the first meeting, which will prioritize discussions on "rules of procedure." With measures to support

victims of nuclear weapons also among the important agenda items, Kmentt, expressing hope that Japan would join as an observer, said, "I would find it regrettable if we have a very strong focus on victim assistance and the government of Japan would not take part in this discussion."

Japan, the only country to have experienced nuclear attacks, has not joined the treaty, apparently in light of its security alliance with the US that provides nuclear deterrence against potential adversaries....

Austria spearheaded the efforts that led to the adoption of the treaty in 2017 with the support of 122 countries and regions. The first meeting, which must be held within one year of the treaty coming into force, is currently scheduled for January in Vienna. But there is a chance it may be

rescheduled to avoid clashing with the review conference on the Nuclear Non-Proliferation Treaty, the dates of which remain undecided having been pushed back multiple times from April last year due to the coronavirus pandemic.

Source: <https://english.kyodonews.net/news/2021/07/84fe9afed68f-coronavirus-outbreak-latest-july-10-2021.html>, 07 July 2021.

NATO

NATO's Nuclear Policy Contradicts its Own Security Objectives

This positive evolution of International Law is strongly rejected by NATO, which claims its "nuclear capability is to preserve peace, prevent coercion, and deter aggression" yet issues thinly veiled threats to those who would join this new UN Treaty. The alliance is creating conditions for proliferation and setting a dangerous precedent. Nuclear disarmament's inertia is a reality. It's carried out by States that possess or support a policy of nuclear deterrence. Compounding the problem, their constant modernization and renewal of their nuclear arsenal undermine the non-proliferation regime.

The treaty, the first international pact outlawing the development, testing, possession and use of nuclear weapons, came into effect in January 2021 with the support of many non-nuclear states. But the US, Russia and other nuclear-armed states have declined to sign the pact and are not expected to participate in the first meeting next year.

And if nuclear-armed states are accountable for nuclear weapons' reduction, states that accept, support, and benefit from this defence system also have a responsibility. No one claims that nuclear disarmament is an easy task. But one thing is certain: not doing anything or going against legal progress is a dangerous game. By rejecting the United Nations Treaty on the Prohibition of Nuclear Weapons (TPNW), the Atlantic Alliance and its 30 democratic regimes have sent a clear signal to non-democratic States on "the right not to comply with International Law".

By rejecting the United Nations Treaty on the Prohibition of Nuclear Weapons (TPNW), the Atlantic Alliance and its 30 democratic regimes have sent a clear signal to non-democratic States on "the right not to comply with International Law".

The TPNW, adopted on 7 July 2017, is in force since 22 January 2021. The Treaty, which has 86 signatures and 54 Member States, will welcome new Member States in the coming months. It benefits from broad global support, as testifies the commitment of cities (Amsterdam, Berlin, Bruges, Paris, Manchester, Oslo, Toronto...) and parliamentarians from NATO Member States, to support it. This Treaty reinforces non-proliferation and allows the implementation of NPT's article 6 (nuclear disarmament). The latter, considered as the backbone of the non-proliferation regime, is in danger. Even the Alliance implicitly recognizes this danger in its Statement, "the enduring success of the NPT cannot be taken for granted".

France wants, in a parallel effort to support NATO, while completely renewing its arsenal, to promote the Europeanization of its nuclear deterrence, through strategic dialogue and the opening of French deterrence exercises to the other European States.

However, this reasonable thinking is confronted with contrary and irresponsible actions by three nuclear States of this Alliance: the UK announced its will to increase its nuclear arsenal, backing away from its 2010 NPT disarmament commitment. France wants, in a parallel effort to support NATO, while completely renewing its arsenal, to promote the Europeanization of its nuclear deterrence, through strategic dialogue and the opening of French deterrence exercises to the other European States. Finally, according to the Congressional Budget Office, the US will

spend a whopping \$634 billion in the next ten years on new nuclear arms systems.

The facts are crystal clear. These states do not respect the "good faith" principle, as required by the NPT and the International Court of Justice

Advisory Opinion (July 7th 1996). The Alliance Statement also undermines the democratic values of the UN and its institution. It is important to be aware that the TPNW was subject to open negotiations (2017), during which all States could be present to

expose their own point of view, and thus, influence the content of the text. Except for the Netherlands, all NATO Member States stayed away from these negotiations. By challenging the TPNW's existence, they are equally challenging the functioning of the UN and of its Secretary-General, who is the depositary of the Ban Treaty. In the report "A Non-Nuclear Alliance: Why NATO Members Should Join the UN Ban on Nuclear

Weapons" (116 pages), the Alliance's arguments were reviewed, point by point, demonstrating that they are based on myths, misconceptions, and deliberate lies. NATO's hostility to the TPNW is in direct contradiction to its own security interests.

By working constructively against the threat posed by nuclear weapons, the Alliance Member States would protect their populations. Yet, today they keep relying on a deterrence policy to tackle this threat – which is only adding fuel to the fire. Some NATO partners, in Europe (Austria, Ireland and Malta) or in Asia-Pacific (New Zealand, Philippines, Thailand), are already States Parties to the TPNW; and more are to come. Others have announced their participation as Observatory States (Finland, Sweden, Switzerland) to the First Meeting of State Parties, which will be held at the UN in Vienna (12th to 14th of January 2022). And the list is expected to grow.

Yet, the Alliance is attempting to sabotage the sovereign will of countries and prevent them from engaging by calling on its "partners and all other countries" of the international community, to think twice before joining the TPNW. This barely veiled threat reveals how scared the three nuclear-armed members are of losing the moral support they need to justify military capabilities, capable of causing catastrophic humanitarian and environmental consequences.

NATO cannot hinder International Law's development. The TPNW has no other objective than to create more security, by becoming universal. When declaring that its member states support "the ultimate goal of a world without nuclear weapons", NATO must see the TPNW as an opportunity to put an end to a threat too many generations have known.

Source: <https://vestnikkavkaza.net/analysis/NATO-s-nuclear-policy-contradicts-its-own-security-objwctives.html>, 09 July 2021.

NUCLEAR SAFETY

CANADA

SRB Technologies Applies to Canadian Nuclear Safety Commission for 15-Year Operating Licence

SRB Technologies Inc. (SRBT) has applied to the Canadian Nuclear Safety Commission (CNSC) to renew its Nuclear Substance Processing Facility Operating Licence for a period of 15 years. SRBT's current operating licence expires on June 30, 2022. SRB has been in operation in Pembroke since 1990. The company currently employs 41 local residents and manufactures self-luminous products for the military, aerospace and construction industry using the radioactive

NATO cannot hinder International Law's development. The TPNW has no other objective than to create more security, by becoming universal. When declaring that its member states support "the ultimate goal of a world without nuclear weapons", NATO must see the TPNW as an opportunity to put an end to a threat too many generations have known.

those used in electrical generating stations. ...SRBT made signs are used to illuminate the way in various commercial buildings, mines and sewer systems. The company also manufactures many illuminated products for the Canadian, American and British military. Its products are also installed in a number of aircraft to illuminate escape doors and routes.

SRBT is requesting the same licensed activities as those described in its existing licence and is proposing to continue operating to the same release limit and observing the same actions levels that are currently in place.

...SRBT is requesting the same licensed activities as those described in its existing licence and is proposing to continue operating to the same release limit and observing the same actions levels that are currently in place. As required by the CNSC a financial guarantee exceeding \$727,327.00, entirely funded by SRBT is in place in a secure escrow account should the facility ever need to be decommissioned in the future....

Source: <https://www.recorder.ca/news/local-news/srb-technologies-applies-to-canadian-nuclear-safety-commission-for-15-year-operating-licence>, 06 July 2021.

CHINA

China Produces its First Used Fuel Transport Cask

China has manufactured its first domestically-designed 100-tonne used fuel transportation cask. China National Nuclear Corporation (CNNC) said batch production of the Longzhou-CNSC cask - which can hold 21 used fuel assemblies - will further consolidate its used fuel transportation

substance tritium.

According to the Canadian Nuclear Safety Commission, tritium is a relatively weak source of beta radiation. It is produced naturally from interactions of cosmic rays with gases in the upper atmosphere and also produced as a by-product of nuclear reactors such as

capabilities. CNNC said the Longzhou-CNSC cask has undergone safety verification tests - such as drop tests and its ability to withstand fire - in accordance with the requirements of regulations and standards.

In 2017, China's National Nuclear Safety Administration approved Xi'an Nuclear Equipment Company's licence application to manufacture used fuel transportation casks. The company at that time was already producing the CNFC-3G cask for the transport of fresh fuel. A prototype Longzhou-CNSC cask passed the acceptance test and was declared ready for batch production on 20 December 2017. The first canister came off the production line on 30 June.

A centralised used fuel storage facility has been built at Lanzhou Nuclear Fuel Complex, 25 km northeast of Lanzhou in central Gansu province. The initial stage of that project has a storage capacity of 550 tonnes. However, most used fuel is currently stored at reactor sites, in ponds. The only dry storage operating is at Qinshan.

CNNC subsidiary CNNC Everclean is responsible for used fuel transport from nuclear power plant sites to the Lanzhou Nuclear Fuel Complex, and storage there. Some used fuel - over 100 fuel assemblies per year - is transported 3700 km by road from Daya Bay to Gansu province for storage. According to the State Administration for Science, Technology and National Defence Industry, this quantity needs to increase to 600 assemblies per year. In June 2018 CNNC Everclean contracted with Holtec International to supply its HI-STAR 100MB casks by 2020. In 2016 it had bought four NAC-STC casks for high-burnup fuel, and in January 2018 Spain's ENSA also supplied a cask.

China has manufactured its first domestically-designed 100-tonne used fuel transportation cask. China National Nuclear Corporation (CNNC) said batch production of the Longzhou-CNSC cask - which can hold 21 used fuel assemblies - will further consolidate its used fuel transportation capabilities.

CNNC announced in December 2020 that it had manufactured its first railway trailer for the transport of used fuel. The D15B trailer, it said at that time, would be used for transporting 100-tonne casks. In January 2021, CNNC announced it had taken delivery of its first ship for the transport of used nuclear fuel. The independently produced *Xin An Ji Xiang* meets the INF-3 (Irradiated Nuclear Fuel class 3) standards set by the International Maritime Organisation. The ship features a double hull, with multiple watertight transverse bulkheads and reinforced structures for side impacts. It is powered by dual main engines, dual propellers, dual steering engines, and has dual independent cabins.

Source: <https://www.world-nuclear-news.org/Articles/China-produces-its-first-used-fuel-transport-cask>, 02 July 2021.

NUCLEAR WASTE MANAGEMENT

GENERAL

Revolutionary Micro Nuclear Reactors will Run on Waste

A major lament against nuclear energy has been the amount of nuclear waste produced by the nuclear plants and our inability to process this waste. But 22 people startup, Oklo, plans to make small-scale reactors that can use the nuclear waste from conventional nuclear power plants, CNBC reported.

Oklo, based in Silicon Valley, wants to disrupt this convention and build smaller nuclear reactors that can offer nuclear-powered energy. To keep the operations cost-effective, the startup wants to build autonomous reactors that do not need human supervision and most importantly use the nuclear waste from larger power plants.

Traditionally, nuclear power plants have been grand affairs taking years to build and begin operations. Like most industrial revolution concepts, nuclear power plants also apply economies of scale to make electric energy cheaply. Oklo, based in Silicon Valley, wants to disrupt this convention and build smaller nuclear

reactors that can offer nuclear-powered energy. To keep the operations cost-effective, the startup wants to build autonomous reactors that do not need human supervision and most importantly use the nuclear waste from larger power plants.

The idea of using nuclear plant waste is not very new and has been around for many decades now. ...In 2019, Oklo unveiled its plans for its microreactor with integrated solar panels making this 1.5 MW plant sustainable and clean. The capacity of the plant might look small compared to traditional power plants but is sufficient to power industrial sites, large companies, and college campuses. The company claims that its microreactors can be built in a year's time paving way for the company's goal of having a number of operational by the mid-2020s.

The reactor uses nuclear waste that is earmarked for disposal and allows it to undergo further fission in its 'fast' reactor. These reactors do not use water or any other material to slow down the neutrons, released during the fission process.

The reactor uses nuclear waste that is earmarked for disposal and allows it to undergo further fission in its 'fast' reactor. These reactors do not use water or any other material to slow down the neutrons, released during the fission process. Since the process is not controlled, it is more efficient. Oklo claims its reactors can work without refueling for 20 years. The waste generated from these plants would radioactive but far lesser than the one that comes out of traditional nuclear plants. Oklo plans to vitrify the waste and bury it underground, in line with current methods of nuclear waste management....

Source: <https://interestingengineering.com/revolutionary-micro-nuclear-reactors-will-run-on-waste>, 30 June 2021.



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, Dr. Hina Pandey, Dr. Poonam Mann, Zoya Akhter, Nasima Khatoun, Rushali Saha, Silky Kaur

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.