We Negate

Contention 1 is Water

Water Quality has been improving. GAO 24

Gao, September 2024, "Water Quality and Protection," No Publication, https://www.gao.gov/water-quality-and-protection, accessed 3-31-2025 //MA

Safe and clean water is necessary for human and environmental health and the nation's economic well-being. **Over the past 50 years, the nation's water quality and drinking water have improved**, but threats to water quality and safety remain. For example, the Environmental Protection Agency (EPA) and the states have identified almost 70,000 water bodies nationwide that do not meet water quality standards. Further, studies show that most people in the U.S. have been exposed to per- and polyfluoralkyl substances (PFAS)—likely from contaminated water, food, or air. Known as forever chemicals, they can persist in the environment and cause adverse health effects. Additionally, emerging contaminants near military bases and other communities has renewed awareness about the risks that lead and other chemical compounds pose to public health. Nation states, cybercriminals, and hacktivists have also attacked the nation's water and wastewater systems, making cybersecurity a top concern. Examples of How Per- and Polyfluoroalkyl Substances (PFAS) Enter the Environment Examples of How Per and Polyfluoroalkyl Substances Enter the Environment The EPA and other federal agencies face a number of challenges in ensuring that the nation has access to safe and clean water. For instance: Contaminants. Under the Safe Drinking Water Act (SDWA), EPA establishes legally enforceable standards that limit the levels of specific contaminants in drinking water. EPA identifies unregulated contaminants, monitors them, and determines whether to regulate them based on things like how dangerous they are to public health, and how often they occur. Public water systems must comply with monitoring, reporting, and other requirements established by EPA and responsible states. But the data that states reported to EPA did not always reflect the frequency of health-based and monitoring violations by community water systems or the status of enforcement actions. Regarding certain PFAS contaminants, public water systems will need to implement a treatment method by 2029. But treating PFAS in drinking water also creates waste that needs to be properly disposed of to avoid future environmental contamination.

However, Nuclear energy is bad for biod

Harvey **Wasserman 16**, American journalist, author, democracy activist, and advocate for renewable energy, strategist and organizer in the anti-nuclear movement in the United States for over 30 years, "How Nuclear Power Causes Global Warming", Progressive, Sept 21 2016, //RR

Supporters of nuclear power like to argue that nukes are the key to combatting climate change. Here's why **they are dead wrong.** Every nuclear generating station spews about two-thirds of the energy it burns inside its reactor core into the environment. **Only one-third is converted into electricity**. **Another tenth of that is lost in transmission.** According to the Union of Concerned Scientists: **Nuclear fission is the most water intensive method** of the principal thermoelectric generation options in terms of the amount of water withdrawn from sources. In 2008, nuclear power plants withdrew eight times as much freshwater as natural gas plants per unit of energy produced, and up to 11 percent more than the average coal plant. Every day, **large reactors like the two at Diablo Canyon, California, individually dump about 1.25 billion gallons of water into the ocean** at temperatures up to **20 degrees Fahrenheit warmer than the natural environment.** Diablo's "once-through cooling system" takes water out of the ocean and dumps it back **superheated, irradiated and laden with toxic chemicals**. Many U.S. reactors use cooling towers which emit huge quantities of steam and water vapor that

also directly warm the atmosphere. These emissions are often chemically treated to prevent algae and other growth that could clog the towers. Those chemicals can then be carried downwind, along with radiation from the reactors. In addition, hundreds of thousands of birds die annually by flying into the reactor domes and towers. The Union of Concerned Scientists states: **The temperature increase in the bodies of water can have serious adverse effects on aquatic life**. Warm water holds less oxygen than cold water, thus discharge from once-through cooling systems can create a "temperature squeeze" that elevates the metabolic rate for fish. Additionally, suction pipes that are used to intake water can draw plankton, eggs and larvae into the plant's machinery, while larger organisms can be trapped against the protective screens of the pipes. Blocked intake screens have led to temporary shut downs and NRC fines at a number of plants. And that's not all. All nuclear reactors emit Carbon 14, a radioactive isotope, invalidating the industry's claim that reactors are "carbon free." And the fuel that reactors burn is carbon-intensive. The mining, milling, and enrichment processes needed to produce the pellets that fill the fuel rods inside the reactor cores all involve major energy expenditures, nearly all of it based on coal, oil, or gas. And of course there's the problem of nuclear waste. After more than a half-century of well-funded attempts, we've seen no solution for the management of atomic power's intensely radioactive waste. There's the "low-level" waste involving enormous quantities of troublesome irradiated liquids and solid trash that must be dealt with outside the standard civilian waste stream. And that handling involves fossil fuels burned in the process of transportation, management, and disposal as well As for the high-level waste, this remains one of humankind's most persistent and dangerous problems. Atomic apologists have claimed that the intensely radioactive spent fuel rods can somehow be usable for additional power generation. But after a half-century of efforts, with billions of dollars spent, all attempts to do that have utterly failed. There are zero successful reactors capable of producing more reactor fuel than they use, or able to derive more energy from the tens of thousands of tons of spent fuel rods they create. Some reactors, like Fukushima, use "mixed-oxide" fuels that have proven to be extremely dirty and expensive. It's possible some of this "MOX" fuel containing plutonium, actually fissioned at Fukushima Unit Three, raising terrifying questions about the dangers of its use. The mushroom cloud that appears on video as Fukushima Unit Three exploded stands as an epic warning against further use of these impossible-to-manage fuels. The MOX facility under construction near Aiken, South Carolina, is now projected to require another ten years to build with another ten possible after that to phase into production. U.S. Secretary of Energy Ernest Moniz said on September 13, 2016, at the Carnegie Endowment for International Peace that the mismanaged project was "impossible" to carry out and that it could cost $30 billion to $50 billion. Even the current pro-nuclear Congress won't fully fund the project and the Department of Energy DOE continues to recommend abandoning it. There are no credible estimates of the global warming damage done by the intensely hot explosions at the four Fukushima reactors, or at Chernobyl, or at any other past and future reactor meltdowns or blowups. Atomic apologists argue that the disposal of high-level reactor wastes should be a relatively simple problem, lacking only the political will to proceed. The industry touts New Mexico's Waste Isolation Pilot Project, or WIPP, which has long been the poster child for military attempts to deal with high-level trash from the nuclear weapons program. Accepting its first shipment of waste in 1999, WIPP was touted as the ultimate high-tech, spare-no-expense model that proved radioactive waste disposal "can be done." But a series of disastrous events in February, 2014, led WIPP to stop accepting wastes—the sole function for which it was designed. Most significant was the explosion of a single barrel of highly radioactive waste materials (it was mistakenly packed with organic rather than clay-based kitty litter). About a dozen WIPP workers were exposed to potentially harmful radiation. The entire facility remains closed. In a phone interview, facility management told me it may again accept some wastes before the end of this year. But at least part of the cavernous underground labyrinth may never be reopened. The Los Angeles Times estimated the cost of this single accident at $2 billion. Overall, the idea that atomic power is "clean" or "carbon free" or "emission free" is a very expensive misconception, especially when compared to renewable energy, efficiency, and conservation. Among conservation, efficiency, solar and wind power technologies, there are no global warming analogs to the heat, carbon, and radioactive waste impacts of nuclear power. No green technology kills anywhere near the number of marine organisms that die through reactor cooling systems. Rooftop solar panels do not lose ten percent of the power they generate to transmission, as happens with virtually all centralized power generators. S. David Freeman, former head of numerous large utilities and author of All Electric America: A Climate Solution and the Hopeful Future, says: "Renewables are cheaper and safer. That argument is winning. Let's stick to it." No terrorist will ever threaten one of our cities by blowing up a solar panel. But the nuclear industry that falsely claims its dying technology doesn't cause global warming does threaten the future of our planet.

Overall, Poor Water quality kills biodiversity. Bagayas 24

Mckenzie Bagayas, a human, 5-21-2024, "How Does Water Pollution Affect Aquatic Biodiversity ," Kraken Sense, https://krakensense.com/blog/water-pollution-aquatic-biodiversity, accessed 3-27-2025 //MA

"Living species variations from sources that include terrestrial, marine, different aquatic ecosystems and also ecological groups to which they belong: including diversity among species and also ecosystems." This is the well-accepted definition of biodiversity that was made by the United Nations Convention on Biological Diversity. Biodiversity could also refer to the variety of life on Earth. Variety of life and living things can come in the form of genetic diversity among species within an ecosystem and diversity of ecological systems. Biodiversity may also include evolutionary, ecological, and cultural processes that sustain life. Biodiversity is not solely about rare, threatened, and endangered species.

Instead, biodiversity is about the interconnectedness of all living things. Although we, humans, are just a single species amidst all of the living things present on this Earth, we are the only species whose actions can have a huge impact on biodiversity. With that said, we have the obligation to try our best to practice biodiversity conservation. Biodiversity - Why is it important People value biodiversity differently, some through a utilitarian lens while others value their intrinsic value. Biodiversity in some form or way is capable of providing for our basic needs like food, fuel, shelter, and even medicine. This is where the utilitarian perspective of the value of biodiversity comes in. Being conscious of the utilitarian value of biodiversity leads to the appreciation of ecosystems. With the appreciation and care of ecosystems natural and beneficial processes such as pollination, seed dispersal, climate regulation, water purification, nutrient cycling, and control of agricultural pests are improved. The utilitarian value of biodiversity could also come in the form of possible unknown services and the possibility of discovering new medicines. Moreover, people also value biodiversity for their cultural, spiritual, and religious value. Biodiversity also holds intrinsic value. In other words, people value biodiversity for its inherent worth regardless of its value to anyone or anything else. The intrinsic value of biodiversity is more of a philosophical concept that can stem from an individual's belief in the right to exist regardless of species. People may also value biodiversity for its relational value. We find value in the intricate relationships we form with nature. These relationships impart a sense of wellbeing, responsibility, and connection. The various ways people value biodiversity are important because this can be leveraged to influence conservation decisions people make every day. How does water pollution affect Biodiversity? **For aquatic environments, pollution poses a serious issue as it can cause variations in the environmental conditions to which aquatic organisms are sensitive. Aquatic organisms respond to drastic changes in their environment by migrating to any other suitable habitat or in extreme cases they just die off.** In less extreme cases only the reproductive capacity **and** metabolism of the aquatic organisms are affected negatively. However, **this can have a negative consequence on their population in the long run.** Every species present in various trophic levels is important for freshwater ecosystems. Zooplankton and macrobenthic organisms modulate the aquatic productivity of aquatic ecosystems by occupying the intermediate level in the food chain. The aforementioned aquatic organisms are also capable of indicating changes in the aquatic environment. Recent studies have demonstrated that some species of zooplankton and macrobenthic organisms can be used as an indicator of deteriorating water quality resulting from eutrophication and or pollution. The intricate relationships between species in a food web are important. Fish numbers may start to dip as a result of food chain disruption and diversity loss or degradation. The relationship between biodiversity decline and food chain disruption was demonstrated when data from two separate studies about the Egyptian Nile waters conducted several years apart were compared side by side. In 1907 the first study reported that there are a total of 85 fish species in the Egyptian Nile waters. However, the second study, which was conducted in 1997, reported that there are a total of 71 fish species. This significant reduction in fish species has been attributed to several pollution sources generated by industrial activities, agricultural sources, and sewage drains. These findings showed evidence that pollution can reduce species diversity and affect the fish population. Studies have also shown that pollution can make rivers more susceptible to drastic changes. In one study, researchers investigated the effects of rising water temperature and low oxygen levels brought about by pollution on the common mayfly species. Mayfly species are considered cool water insects and they are used as bioindicators that help determine ecologically important features of freshwater ecosystems. During warmer seasons, they have trouble thriving in polluted waters due to elevated temperatures and reduced dissolved oxygen; conditions that the mayfly species are not accustomed to. In a controlled laboratory setting, mayfly species such as the green drake and blue-winged olive, or Ephemera danica and Serratella ignita respectively, are capable of tolerating higher temperatures where dissolved oxygen levels are sufficient. Lowered oxygen levels, near depletion, can lower the mayflies' ability to tolerate temperature extremes. These laboratory findings were substantiated by field study data. Analysis of data collected by the Environment Agency and Natural Resources Wales demonstrated that mayflie populations dropped when the freshwater oxygen concentration decreased and temperature increased. **So with all the findings of the studies combined, there is strong evidence that water pollution can reduce dissolved oxygen in freshwater environments and increase temperature. Moreover, reductions in dissolved oxygen compromised the mayflies' ability to survive temperature extremes. Their ability to increase in numbers was also severely restricted even at temperatures below the lethal limits.** Improving dissolved oxygen levels in freshwater environments is one method of improving their resilience against rising temperatures. By reducing the amount of pollution, especially those of agricultural origins, the freshwater environment can absorb oxygen better. This is supported by a review published in Global Change Biology, which mentioned that there is growing evidence that freshwater ecosystems that contain minimal pollution are resilient against changes brought about by climate change. Pollution reduction may also help improve biodiversity in the freshwater ecosystem.

Any biodiversity loss would cause cataclysmic extinction for all species, including humans

University of Exeter 18 (The University of Exeter is a public research university in Exeter, Devon, South West England, United Kingdom, Febuary 29th 2018, “Biodiversity loss raises risk of 'extinction cascades” Science Daily, https://www.sciencedaily.com/releases/2018/02/180219155019.htm#:~:text=New%20research%20shows%20that%20the,domino%20effect%20of%20further%20extinctions.&text=%22And%20because%20species%20are%20interconnected,can%20affect%20others%20as%20well. February 9th 2021)

The researchers, from the University of Exeter, showed there is a higher risk of extinction cascades when other species are not present to fill the "gap" created by the loss of a species. **Even if the loss of one species does not directly cause knock-on extinctions, the study shows that this leads to simpler ecological communities that are at greater risk of "run-away extinction cascades" with the potential loss of many species. With extinction rates at their highest levels ever and numerous species under threat due to human activity, the findings are a further warning about the consequences of eroding biodiversity. "Interactions between species are important for ecosystem (a community of interacting species) stability,"** said Dr Dirk Sanders, of the Centre for Ecology and Conservation at the University of Exeter's Penryn Campus in Cornwall. "And because **species are interconnected through multiple interactions, an impact on one species can affect others as well. "It has been predicted that more complex food webs will be less vulnerable to extinction cascades because there is a greater chance that other species can step in and buffer against the effects of species loss**. "In our experiment, we used communities of plants and insects to test this prediction." The researchers removed one species of wasp and found that it led to secondary extinctions of other, indirectly linked, species at the same level of the food web. This effect was much stronger in simple communities than for the same species within a more complex food web. Dr Sanders added: "**Our results demonstrate that biodiversity loss can increase the vulnerability of ecosystems to secondary extinctions which, when they occur, can then lead to further simplification causing run-away extinction cascades**." The study, supported by France's Sorbonne Université, is published in the journal Proceedings of the National Academy of Sciences. The paper is entitled: "Trophic redundancy reduces vulnerability to extinction cascades." How extinction cascades work The loss of a predator can initiate a cascade, such as in the case of wolves, where their extinction on one mountain can cause a large rise in the number of deer. This larger number of deer then eats more plant material than they would have before. This reduction in vegetation can cause extinctions in any species that also relies on the plants, but are potentially less competitive, such as rabbits or insects.

Independently, mass Biodiversity loss causes nuclear war. Torres 16

TORRES Institute for Ethics and Emerging Technologies 2016 (Phil, affiliate scholar at the Institute for Ethics and Emerging Technologies, “Biodiversity Loss and the Doomsday Clock: An Invisible Disaster Almost No One Is Talking About”, Common Dreams, Feb 10, , [CORNELL DBT] note://// indicates par.breaks)[AR UMW17] //MA

But there’s another global catastrophe that the Bulletin neglected to consider — a catastrophe that will almost certainly have conflict multiplying effects no less than climate change. I’m referring here to biodiversity loss — i.e., the reduction in the total number of species, or in their population sizes, over time. The fact is that in the past few centuries, the loss of biological diversity around the world has accelerated at an incredible pace. Consider the findings of a 2015 paper published in Science Advances. According to this study, we’ve only recently entered the early stages of the sixth mass extinction event in life’s entire 3.5 billion year history. The previous mass extinctions are known as the “Big Five,” and the last one wiped out the dinosaurs some 65 million years ago. Unlike these past tragedies, though, the current mass extinction — called the “Holocene extinction event” — is almost entirely the result of a one species in particular, namely Homo sapiens (which ironically means the “wise man”).//// But biodiversity loss isn’t limited to species extinctions. As the founder of the Long Now Institute, Stewart Brand, in an article for Aeon, one could argue that a more pressing issue is the reduction in population sizes around the globe. For example, the (GBO-3), published in 2010, found that the total abundance of vertebrates — a category that includes mammals, birds, reptiles, sharks, rays, and amphibians — living in the tropics declined by a whopping 59% between 1970 and 2006. In other words, the population size of creatures with a spine more than halved in only 36 years. The study also found that farmland birds in Europe have declined by 50% since 1980, birds in North America have

declined by 40% between 1968 and 2003, and nearly 25% of all plant species are currently "threatened with extinction." The latter statistic is especially worth noting because many people suffer from what's called "," according to which we fail "to recognize the importance of plants in the biosphere and in human affairs." Indeed, plants form the very bottom of the food chains upon which human life ultimately depends.//// Even more disturbing is the claim that amphibians "face the greatest risk" of extinction, with "42% of all amphibian species … declining in population," as the GBO-3 reports. Consistent with this, from 2013 that focused on North America found that "frogs, toads and salamanders in the United States are disappearing from their habitats … at an alarming and rapid rate," and are projected to "disappear from half of the habitats they currently occupy in about 20 years." The decline of amphibian populations is ominous because amphibians are "ecological indicators" that are more sensitive to environmental changes than other organisms. As such they are the "canaries in the coal mine" that reflect the overall health of the ecosystems in which they reside. When they start to disappear, bigger problems are sure to follow.//// Yet comes from the Living Planet Report — and its results are no less dismal than those of the GBO-3. For example, it finds that the global population of vertebrates between 1970 and 2010 dropped by an unbelievable 52%. **Although the authors refrain from making any predictions based on their data, the reader is welcome to extrapolate this trend into the near future, noting that as ecosystems weaken, the likelihood of further population losses increases.** This study thus concludes that humanity would "need 1.5 Earths to meet the demands we currently make on nature," meaning that we either need to reduce our c ollective consumption and adopt less myopic economic policies or hurry up and start colonizing the solar system.//// Other studies have found that , , , and are currently threatened with extinction. There's also talk about the Cavendish banana , and research has confirmed that honey bees, "the most important insect that transfers pollen between flowers and between plants," are dying out around the world at an alarming rate due to what's called "colony collapse disorder" — perhaps a good metaphor for our technologically advanced civilization and its self-destructive tendencies.//// Turning to the world's oceans, one finds few reasons for optimism here as well. Consider the fact that atmospheric carbon dioxide — the byproduct of burning fossil fuels — is not only warming up the oceans, but it's making them . The resulting changes in ocean chemistry are inducing a process known as "coral bleaching," whereby coral loses the algae (called "zooxanthellae") that it needs to survive. Today, . This has direct consequences for humanity "provide us with food, construction materials (limestone) and new medicines," and in fact "more than half of new cancer drug research is focused on marine organisms." Similarly, yet found that ocean acidification is becoming so pronounced that the shells of "tiny marine snails that live along North America's western coast" are literally dissolving in the water, resulting in "pitted textures" that give the shells a "cauliflower" or "sandpaper" appearance.//// Furthermore, human-created pollution that makes its way into the oceans is carving out vast regions in which the amount of dissolved oxygen is too low for marine life to survive. These regions are called "dead zones," and by Robert Diaz and his colleagues found more than 500 around the world. The biggest dead zone discovered so far is located in the Baltic Sea, and it's been estimated to be about 27,000 square miles, or a little less than the size of New Hampshire, Vermont, and Maryland combined. Scientists have even discovered an "island" of trash in the middle of the Pacific called the "Great Pacific Garbage Patch" that could be up to "." Similar "patches" of floating plastic debris can be found in the Atlantic and Indian oceans as well, although these are not quite as impressive. The point is that "Earth's final frontier" — the oceans — are becoming vast watery graveyards for a huge diversity of marine lifeforms, and in fact in Science predicts that there could be virtually no more wild-caught seafood by 2048.//// Everywhere one looks, the biosphere is wilting — and a single bipedal species with large brains and opposable thumbs is almost entirely responsible for this worsening plight. If humanity continues to prune back the Tree of Life with reckless abandon, we could be forced to confront a global disaster of truly unprecedented proportions. Along these lines, published in Nature and authored by over twenty scientists claims that humanity could be teetering on the brink of a catastrophic, irreversible collapse of the global ecosystem. **According to the paper, there could be "tipping points" — also called "critical thresholds" — lurking in the environment that, once crossed, could initiate radical and sudden changes in the biosphere. Thus, an event of this sort could be preceded by little or no warning: everything might look more or less okay, until the ecosystem is suddenly in ruins.//// We must, moving forward, never forget that just as we're minds embodied, so too are we bodies environed, meaning that if the environment implodes under the weight of civilization, then civilization itself is doomed. While the threat of nuclear weapons deserves serious attention from political leaders and academics, as the Bulletin correctly observes, it's even more imperative that we focus on the broader "contextual problems" that could inflate the overall probability of wars and terrorism in the future. Climate change and biodiversity loss are both conflict multipliers of precisely this sort, and each is a contributing factor that's exacerbating the other. If we fail to make these threats a top priority in 2016, the likelihood of nuclear weapons — or some other form of emerging technology, including biotechnology and artificial intelligence — being used in the future will only increase.**//// Perhaps there's still time to avert the sixth mass extinction or a sudden collapse of the global ecosystem. But time is running out — the doomsday clock is ticking.

And nuclear war causes extinction. Goytchev ‘8.

Sargoytchev 8. (Dr. Stoyan Sargoytchev, Engineering Diploma, PhD in Physics in the Field of Space Research, Worked with European Space Agency, Worked with the Program Intercosmos Coordinated by the Former Soviet Union, Visiting Scientist @ Cornell Univ, Worked in Arecibo Observatory, Currently Works with the Canadian Space Agency, and York University, Editor in Chief. “MANIFESTO: Prevent Nuclear Disaster – Doomsday” Paper Prepared by International Group of Scientists and Engineers, https://drive.google.com/file/d/1OMZpbkEkwxqq5jO2Wg0cj1bjr40mugUS/view?usp=sharing] SARG = Stimulated Anomalous Reaction to Gravity

One new physical phenomenon that resulted from antigravity research was reported at the 27 th Annual Meeting of the Society for Scientific Exploration, 25-28 June, 2008, in Boulder, CO, USA [2]. The unique gravito-inertial phenomenon achieved in the laboratory was called Stimulated Anomalous Reaction to Gravity (SARG). It was a result of years of research following successful theoretical predictions, and was supported by international private organizations. The theoretical and experimental research leading to the discovery of this effect were published at a number conferences and international meetings, and is the subject of a patent application [3,4,5]. In parallel with the laboratory experiments, extensive analysis was done on the effects of nuclear tests in the atmosphere using the physics behind the observed SARG effect. **A large quantity of** unclassified **nuclear test data from** both **the USA and** the former **Soviet Union** was used. Pictures and technical specs, as well as video material, are available via the Internet. The videos are **useful for observing** the **dynamics in the first few seconds of the nuclear explosion** when unusual phenomena take place. **It was observed that an extremely large scale SARG effect takes place** in the first few seconds or tens of seconds. The effect is stronger when the nuclear explosion takes place in the atmosphere between 200 m to 2 km above the ground. It is less strong at higher altitudes due to the rarefied atmosphere. Even for the non-scientist,**the effect of antigravity is apparent** in several videos such as the unclassified documentary movie entitled “Declassified U.S. Nuclear Test Film #70” [6]. The atmospheric nuclear test near the beginning of the documentary occurs at an altitude of 610 m from the ground. **As the plasma from the nuclear explosion expands, a thick column of dust and condensed air begins to rise from the ground**. It reaches the expanding plasma **in** about 20 sec. **Small**-diameter **tornado-like columns also arise simultaneously, and this** phenomenon **is very common during** atmospheric **nuclear explosions.** Note that the rising main column not only reaches the bulk of expanded plasma but also punches through it. **The SARG effect explains the rising column and surrounding tornados.** The nuclear explosion causes the formation of a vast quantity of expanding plasma. **This plasma affects the physical vacuum in such a way that an antigravity effect is created below the nuclear explosion.** The dust and condensed gases rise because of the antigravity effect. **They obtain a vertical pulse momentum during the existence of the plasma resulting from the explosion**, which may last for a few seconds to tens of seconds. The explosion also creates another detectable effect – a strong EM pulse. (In the laboratory experiment demonstrating the SARG effect, such a pulse is quite weak and is invoked by other means). The rising column and the expanding plasma create the well-known shape of the nuclear mushroom cloud. The same antigravity phenomenon with multiple tornados is also visible in the videos [7,8] of other atmospheric nuclear tests. From 1945 to 1963 the USA conducted an extensive campaign of atmospheric nuclear tests, grouped into roughly 20 test series [9]. USSR also conducted extensive atmospheric nuclear tests in the period from 1949 to 1962. They are summarized in a Catalog of Worldwide Nuclear Testing edited by V. N. Michailov [10]. After the Limited Test Ban Treaty was signed in 1963, testing by the U.S., Soviet Union, and Great Britain moved underground. France continued atmospheric testing until 1974 and China did so until 1980. In all the available information, there is no indication that simultaneous atmospheric nuclear tests separated by a finite distance have ever been performed. This has been our good fortune, as we will see. **In a single** atmospheric **test, the antigravity effect is** usually **directed** vertically **upward. But what might**

happen if simultaneous tests within a finite time and distance were done? The disturbance of the physical vacuum would lead to an antigravity effect that is not vertical. Additionally, the two disturbances would interact and the columns from the rising dust and gases will be twisted. The new **physics of this phenomenon predicts that the anti gravity effect from the two explosions will be much stronger. This may cause a part of the atmosphere to be thrown into space.** Further, it is possible that **a self-supported tornado-like effect may extend the life of the phenomenon, so a significant fraction of the earth's atmosphere may be sucked into space. This is more than just speculation since exactly such an effect was observed on the Sun by some solar orbit satellites**[11,12]. The video clip on the National Geographic website [13] clearly shows the dynamics of the solar tornado extended into space. Now scientists claim that such a tornado is responsible for throwing large quantities of solar gaseous mass into space [14]. The phenomenon observed at the Sun could happen on the Earth during simultaneous nuclear atmospheric explosions that create similar conditions. To understand the gravity effects, one must have a correct model of the physical vacuum. The model adopted about 100 years ago is now not supported by laboratory experiments. We may think that the space outside the earth's atmosphere is empty but it still has the properties of the physical vacuum, and many experiments show that it is not void. This new understanding is completely unknown to military advisors and politicians. They don't have a clear idea what could happen during multiple nuclear explosions in the atmosphere because, fortunately, such experiments have never been done. We must not think that the atmosphere is something permanent and cannot be destroyed. The planet Mars is a good example of an atmosphere's vulnerability. Once Mars had an atmosphere. This is evident from apparent surface erosion from rivers. Now the atmospheric pressure on Mars is about 0.1% of Earth's atmospheric pressure. Mars lost its atmosphere probably because of some natural event such as a huge volcanic eruption. If the policy of preemptive nuclear strike is applied during a military conflict, there will likely be multiple cases of simultaneous nuclear explosions within a limited range and time. The probability is high that conditions will be created which can result in the loss of a fraction of the Earth atmosphere. Let us describe the consequences of this worst-case scenario that might develop during the initial phase of the nuclear strikes. If an atmospheric sucking-tornado effect occurs somewhere, the first effect will be a huge windstorm that equalizes the atmospheric pressure. This, of course, will not stop the nuclear strikes. The worst case is that the **global atmospheric pressure will drop below some critical level. It is well known that human beings are quite sensitive to changesin atmospheric pressure.** (Even a trained mountain climber could not climb a peak higher than 5 km without an oxygen mask). At some low level of atmospheric pressure, **a person loses consciousness. Since the effect of a pressure drop will be permanent, there is no chance of returning to consciousness.** Protective measures exist to counter all known effects of a nuclear explosion: i.e., direct radiation, shock waves, and radioactivity. **Protection from reduced atmospheric pressure, however, is impossible.** In the worst-case scenario,**there will be no survivors. It does not matter who you are** rich or poor, **living in a highly developed or a poor country, in an urban or low populated area. Everyone on Earth will die. This may happen in a time interval of 1-3 days.** The dead people will lay unburied together with animals. Microbes and fungi will survive while the **biomass of Earth's human and animal population slowly disintegrates.** This will be a very tragic end to Earth's civilization; a civilization that reached its apogee in order to destroy itself. **There will be no one leftto document the end of humankind.**

Contention two is The NRC or nuclear regulatory commission

The NRC maintains nuclear safety now.

Goldfin 23 [Robert P. Goldfin and Jane Accomando, 12-22-2023, "NRC to Increase Focus on Appendix B Compliance in View of FY2023 Enforcement Findings," MorganLewis, https://www.morganlewis.com/blogs/upandatom/2023/12/nrc-to-increase-focus-on-appendix-b-compliance-in-view-of-fy2023-enforcement-findings, DOA: 3/30/2025] JZ + shaan

The US Nuclear Regulatory Commission (NRC) recently published its annual vendor newsletter, The Vendor Times, documenting findings of NRC vendor inspection staff and lessons learned related to the vendor inspection program. The newsletter follows the NRC's November 20 vendor inspection program self-assessment for fiscal year 2023. Through these two issuances, the NRC noted an increase in enforcement findings and indicated that it will focus on 10 CFR Part 21 and supplier oversight compliance during future inspections.

FY2023 Vendor Inspection Metrics

In fiscal year 2023, the NRC vendor inspection staff conducted 22 inspections for operating reactors, including 18 vendor inspections, one licensing audit, and three observations of Nuclear Procurement Issues Corporation audits. These compliance monitoring actions led the NRC to issue 12 notices of nonconformance (NOCs) and four notices of violation (NOVs) for eight vendors, an overall increase in the total number of findings over fiscal year 2022. None of the NOCs or NOVs were contested.

The NRC identified that this increase in NOCs and NOVs is mainly in the areas of corrective actions, 10 CFR Part 21, and supplier oversight. Therefore, the NRC stated it will focus on these areas during future inspections and stress the importance of adequately implementing correction action and 10 CFR Part 21 programs to vendors. With respect to supplier oversight, the NRC will focus on the areas of commercial-grade dedication and supplier audits.

NRC vendor inspection staff also supported 47 allegation actions during fiscal year 2023, one of which resulted in a reactive inspection.

Lessons Learned

The NRC continues to support the implementation of Inspection Procedure (IP) No. 71111.21N.03, Commercial Grade Dedication, last revised in March 2023. To that end, NRC staff supported technical process and inspection implementation training for regional inspectors, including tabletop scenario discussions, and engaged in discussions with stakeholders to provide clarity on the IP.

The NRC will carry out inspections through 2026, and each nuclear plant site will have an inspection. As of October 2023, the NRC has completed 20 inspections, identifying seven noncited violations. The NRC identified the following common themes associated with the noncited violations:

Affirming overstretches resources, killing implementation.

Gilbert 21 [Alex Gilbert, 5-15-2021, A complex systems researcher with expertise in nuclear innovation, space mining, energy markets, and climate policy. "Unlocking Advanced Nuclear Innovation: The Role of Fee Reform and Public Investment," Nuclear Innovation Alliance, https://www.nuclearinnovationalliance.org/unlocking-advanced-nuclear-innovation-role-fee-reform-and-public-investment, DOA: 3/30/2025] JZ + shaan

Due to the limited resources and flexibility, NRC was unable to proactively develop rules and perform technical activities for advanced reactors. Many of these are now being done on an adhoc basis for individual applications. The current fee model creates uncertainty for developers, customers, and investors as NRC reviews of advanced reactors can be lengthy and thus involve unexpected and open-pended licensing review costs. While the NRC regulations require fees to recover "full cost" of NRC's review, there is no way to predict what that "full cost" will be and therefore what the fees will be. In some cases, at the time that NRC accepts an application for review, it has provided an estimate of how much the fees will be. But that estimate is only an estimate. The applicant is still responsible for the full cost, regardless of the estimate.

Congress addressed some of these concerns when it passed NEIMA (See Section 2.c.). Off-fee funding in NEIMA and subsequent legislation are providing initial resources for NRC activities to build advanced reactor regulatory infrastructure. While NIA applauds these activities, expanded and more durable public resources are needed to ensure NRC remains a global leader in nuclear regulation. In addition, a more holistic review and revision to NRC's fee structure can address the underlying issues that NEIMA attempted to address.

Fees are an important consideration for commercializing advanced reactors, and nearterm licensing activities make reconsideration of licensing fees an urgent imperative. In the case of fees collected for NuScale's recent design certification, estimated upfront licensing fees were equivalent to at least 10-15 years of annual fees for operating facilities. 12 These costs could be even more significant for combined or operating license applicants who must recoup fees through revenues from a specific and limited customer base. As licensing fees occur at the beginning of the project, they require equity or debt servicing until operation commences, and can have large impacts on a project's net present value. Therefore, even though fees are only a small part of a project's lifecycle cost, they can have disproportionate impacts on early-stage projects and even discourage consideration of nuclear energy in the first place.

Today, NRC's regulatory framework for licensing reviews is largely predicated on review of large light-water reactors. To apply this framework to advanced reactors requires extensive company and staff work to identify non-applicability of regulations, exemptions, and other adaptations. This can cause initial advanced reactor reviews to take longer and cost more than historical reviews. This conflicts with the general principle of risk-informed, performancebased regulation. Advanced reactors are expected to be significantly safer than past designs, and the fees incurred should be reflective of the enhanced safety, rather than a result of inefficient requirements. Until regulations are modernized, fees pose additional undue burdens on innovators and may be costlier compared to licensing with performance-based regulatory frameworks in other countries.

That shreds oversight.

CBS 19 [CBS News, 7-17-2019, CBS News is the news division of the American television and radio broadcaster CBS. It is headquartered in New York City. "Nuclear Regulatory Commission mulls cutting back on inspections at nuclear reactors,"CBS News, https://www.cbsnews.com/news/nuclear-regulatory-commission-mulls-cutting-back-on-inspections-at-nuclear-reactors/, DOA: 3/30/2025] JZ

Washington – The staff of the Nuclear Regulatory Commission is recommending that the agency cut back on inspections at the country's nuclear reactors, a cost-cutting move promoted by the nuclear power industry but denounced by opponents as a threat to public safety.

The recommendations, made public Tuesday, include reducing the time and scope of some annual inspections at the nation's 90-plus nuclear power plants. Some other inspections would be cut from every two years to every three years.

Some of the staff's recommendations would require a vote by the commission, which has a majority of members appointed or reappointed by President Trump, who has urged agencies to reduce regulatory requirements for industries.

The nuclear power industry has prodded regulators to cut inspections, saying the nuclear facilities are operating well and that the inspections are a financial burden for power providers. Nuclear power, like coal-fired power, has been struggling in market completion against cheaper natural gas and rising renewable energy.

While Tuesday's report made clear that there was considerable disagreement among the nuclear agency's staff on the cuts, it contended the inspection reduction "improves efficiency while still helping to ensure reasonable assurance of adequate protection to the public."

Commission member Jeff Baran criticized the proposed changes Tuesday, saying reducing oversight of the nuclear power industry "would take us in the wrong direction."

"NRC shouldn't perform fewer inspections or weaken its safety oversight to save money," Baran said.

The release comes a day after Democratic lawmakers faulted the NRC's deliberations, saying they had failed to adequately inform the public of the changes under consideration.

"Cutting corners on such critical safety measures may eventually lead to a disaster that could be detrimental to the future of the domestic nuclear industry," Rep. Frank Pallone, D-N.J., chair of the House Energy and Commerce Committee, and other House Democrats said in a letter Monday to NRC Chairwoman Kristine Svinicki.

Asked for comment Tuesday, NRC spokespeople pointed to the staff arguments for the changes in the report. Trimming overall inspections "will improve effectiveness because inspectors again will be focused on issues of greater safety significance," staffers told commission members in the recommendations.

Edwin Lyman, a nuclear-power expert at the nonprofit Union of Concerned Scientists, faulted the reasoning of commission staff that the good performance of much of the nuclear power industry warranted cutting back on agency inspections for problems and potential problems.

"That completely ignores the cause-and-effect relationship between inspections and good performances," Lyman said.

Accidents deck biodiversity.

Olsson et al. 11 [Henrik von Wehrden, Joern Fischer, Patric Brandt, Viktoria Wagner, Klaus Kümmerer, Tobias Kuemmerle, Anne Nagel, Oliver Olsson, Patrick Hostert, 12-28-2011, Chair of Material Resources, Institute of Environmental Chemistry, Leuphana University Lüneburg, Scharnhorststr, 1, 21335 Lüneburg, Germany "Consequences of nuclear accidents for biodiversity and ecosystem services," Society for Conservation Biology, https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/j.1755-263X.2011.00217.x, DOA: 3/30/2025] JZ

To characterize and quantify the potential consequences of nuclear accidents for biodiversity and ecosystem services, we reviewed 521 published studies investigating the impacts of the Chernobyl disaster, which, until now, has been the only available baseline event to empirically judge the consequences of catastrophic nuclear accidents (see online Supplementary Material for Methods). Specifically, our study aimed to (1) provide a summary of the spatial and temporal patterns of the documented effects of the Chernobyl disaster on a wide range of organisms, and (2) discuss the implications of nuclear accidents for the provision of ecosystem services, again, drawing on documented evidence in the aftermath of the Chernobyl accident. We conclude with four tangible take-home messages, intended to be directly relevant to debates about the future of nuclear energy.

Consequences or impacts to species

Spatially, the documented effects of the Chernobyl disaster broadly follow known fallout patterns (Figure 1). However, variance in radiation levels is extremely high, not only between but also within sites. At a given study location, radiation levels have been shown to vary from 44,300 to 181,100 Becquerel per kilogram (Bq/kg) for mushrooms in southern Sweden (Mascanzoni 2009), from 3,000 to 50,000 Bq/kg for bats in Chernobyl (Gashchak et al. 2010), and from 176 to 587,000 Bq/kg for higher plants in southwestern Russia (Fogh & Andersson 2001); the latter equals almost a hundred times the threshold (600 Bq/kg) set by the European Union for Food that is deemed safe for consumption. High variance in radiation levels means that fallout maps based on extrapolations, models, and climate forecasts are not sufficient to evaluate radiation levels on a fine scale—field data are critically important for this purpose. Furthermore, radiation levels measured in the field and predicted fallout patterns based on meteorological data sometimes do not match (McAulay & Moran 1989), because additional factors, such as dry deposition, are not accounted for by climatic predictors (Arvelle et al. 1990). In addition, some regions and types of ecosystems are systematically underrepresented in studies to date. For example, existing data is sparse for marine and aquatic ecosystems (Figure 1).

Although many measurements were undertaken in the aftermath of the Chernobyl accident worldwide, existing studies are greatly biased toward few taxonomic groups (Figures 2 and 3). Most studies have focused on topsoil measurements and accumulation in the plant layer, which is where radiation can be most easily measured. Despite this bias, it is clear that for most well-studied groups, greatly elevated radiation levels can occur up to thousands of kilometers away from the disaster site. For example, recorded radiation levels in mushrooms were up to 13,000 Bq/kg in Denmark in 1991 (Strandberg 2003) and up to 25690 Bq/kg in Norway in 1994 (Amundsen et al. 1996).

The consequences of elevated radiation levels in many parts of a given ecosystem remain poorly understood, but are likely substantial. For example, rats showed changes in sleep behavior after drinking water poisoned with “only” 400 Bq/l (Lestaevel et al. 2006), and onions have shown a significantly elevated rate of chromosomal aberrations at levels as low as 575 Bq/kg (Kovalchuk et al. 1998).

Although numerous studies have investigated physiological and morphological alterations in the vicinity of the Chernobyl accident site, hardly any studies have quantified the possibility of such alterations at larger distances. This could be a major shortcoming, because radiation levels are known to be greatly increased in some organisms even at large distances from the accident site (see earlier)—physiological or morphological alterations, therefore, are plausible, at least in isolated instances. Where such alterations occur, their long-term consequences on the ecosystem as a whole can be potentially profound (Kummerer & Hofmeister 2009).

The legacies of the environmental consequences of the Chernobyl accident are still prevalent today, 25 years after the event. Although many studies have shown a peak in radiation immediately after the catastrophe and then a continuous decline, radiation levels measured throughout the ecosystem are still highly elevated. For example, radiation levels in mosses (Marovic et al. 2008), soil (Copplestone et al. 2000), and glaciers (Tieber et al. 2009) have remained greatly elevated in several locations around Europe. The long-lasting legacy of the Chernobyl accident was also illustrated by intense wildfires in the Chernobyl region in 2010, which caused a renewed relocation of radioactive material to adjacent regions (Yoschenko et al. 2006). The persistence of high radiation levels can be attributed partly to the half-life rates of the chemical elements involved (e.g., 31 years for Caesium-137; 29 years for Strontium-90; and 8 days for Iodine-131).

In addition to elevated radiation levels, morphological and physiological changes are by definition long-term in nature, and can even be permanent if genetic alterations occur. For example, a range of bird species now have developed significantly smaller brains inside the core zone around the Chernobyl reactor site compared to individuals of the same species outside this zone (Møller et al. 2011). The consequences of such changes on long-term evolutionary trajectories remain largely unknown.

Lethal mutations following exposure to nuclear fallout have been observed in various plant (Abramov et al. 1992; Kovalchuk et al. 2003) and animal species (Shevchenko, et al. 1992; Zainullin et al. 1992), yet research has mainly been conducted within the Chernobyl region. Morphological changes have also been observed in a wide array of species, including plants (Tulik & Rusin 2005), damselflies (Muzlanov 2002), diptera (Williams et al. 2001), and mice (Oleksyk et al. 2004). In addition, some studies have documented.

Physiological effects, such as changes in the leukocyte level (Camplani et al. 1999) and reduced reproduction rates (Møller et al. 2008). Changes in genetic structure have been recorded in various organisms, including fish (Sugg et al. 1996) and frogs (Vinogradov & Chubinishvili 1999). More broadly, elevated radiation can negatively affect the abundance of entire species groups, such as insects and spiders (Møller & Mousseau 2009a), raptors (Møller & Mousseau 2009b), or small mammals (Ryabokon & Goncharova 2006).

How low levels of radiation affect different species is poorly understood; studies have suggested that low levels of radiation can have a persistent influence on mutation rates in Drosophila (Zainullin et al. 1992), and can weaken immune (Malyzhev 1993) and reproductive systems (Serkiz 2003) of small mammals; but again, most studies have been restricted to the Chernobyl accident area. A more obvious measure of permanent change is widespread death of organisms living in the direct vicinity of the disaster site (Figures 1 and 2).

Food web and ecosystem impacts

In addition to effects on individual species, biological accumulation through the food web can negatively affect some species—particularly those at higher trophic levels and those depending on strongly affected food items. Bioaccumulation poses a risk to affected species because it exacerbates exposure to elevated radiation levels, and hence, leads to increased chances of physiological or morphological alterations. For example, can radiation levels in top predators remain elevated for a long time even when species at lower trophic levels show negligible radiation levels, as demonstrated for the Trench (Tinca tinca) in the Kiev Reservoir (Koulikov 1996).

Cross apply both impacts for biodiversity from C1

Contention three is terror

Nuclear facilities are safe for now.

Earnhardt et al 21 (Rebecca L Earnhardt, Research Associate with the Nuclear Security program at the Stimson Center. Her research focuses on emerging technology threats to nuclear facilities, adaptation of nuclear security plans in times of crisis, and international nuclear security governance, Brendan Hyatt, nuclear security intern at the Stimson Center, Nickolas Roth, senior director of Nuclear Materials Security at the Nuclear Threat Initiative and senior research associate at the Project on Managing the Atom at the Harvard Kennedy School's Belfer Center for Science and International Affairs, 14 January 2021, "A threat to confront: far-right extremists and nuclear terrorism", Bulletin of the Atomic Scientists, https://thebulletin.org/2021/01/a-threat-to-confront-far-right-extremists-and-nuclear-terrorism/, DOA 3/28/2025) ESR

Could they really pull it off? While some violent far-right extremists are clearly motivated to carry out catastrophic terrorist attacks, a question remains: Do they possess the means and opportunity to conduct an act of nuclear terrorism? There is no public evidence violent far-right extremist groups have obtained the resources or exhibited the requisite operational sophistication to carry out an act of nuclear terrorism. Many of the plots involving far-right extremists and nuclear terrorism have been poorly conceived and were unlikely to succeed. These incidents, however, likely do not provide a complete picture of the threat, because publicly accessible information on the capability of these groups is limited, creating ambiguity about their general capabilities.

Affirming drastically increase the risk of nuclear terror

Pashby 25 (Tom Pashby: contributor for the New Civil Engineer. 1/10/25, "US Government assessing risk of SMRs being used to make dirty bombs", New Civil Engineer,

https://www.newcivilengineer.com/latest/us-government-assessing-risk-of-smrs-being-used-to-make-dirty-bombs-10-01-2025/ // DOA: 3/13/25)JDE

The risk of small modular reactors (SMRs) being used to provide access to materials for dirty bombs (radioactive explosive devices) is being reviewed by the US Government. The review follows the publication of a paper published in the Science journal looking at the increase in **demand for high-assay low-enriched uranium (HALEU) which can be used to fuel advanced modular reactors** (AMRs) **and SMRs.** The paper, titled The weapons potential of high-assay low-enriched uranium posited that "Recent promotion of new reactor technologies appears to disregard decades-old concerns about nuclear proliferation". Scott Kemp , Edwin S. Lyman, Mark R. Deinert, Richard L. Garwin, and Frank N. von Hippel authored the paper, which said: **"Preventing the proliferation of nuclear weapons has been a major thrust of international policymaking for more than 70 years. "Now, an explosion of interest in a nuclear reactor fue**l called high-assay low-enriched uranium (HALEU), **spurred by billions of dollars in US Government funding, threatens to undermine that system of control**. "HALEU contains between 10 and 20% of the isotope uranium-235. At 20% 235U and above, the isotopic mixture is called highly enriched uranium (HEU) and **is internationally recognised as being directly usable in nuclear weapons.** "However, the practical limit for weapons lies below the 20% HALEU-HEU threshold. "**Governments** and others promoting the use of HALEU **have not carefully considered the potential proliferation and terrorism risks** that the wide adoption of this fuel creates." The "terrorism **risks**" the paper refers to **can be understood to mean the creation of dirty bombs, which are relatively low-tech devices. Conventional explosives are used, rather than fission or fusion reactions, to spread radioactive material.** US Government responds to paper announcing review U.S. Department of Energy under secretary for nuclear security and National Nuclear Security Administration (NNSA) administrator Jill Hruby wrote a letter published on 2 January in the peer review 'eLetters' section of the academic paper published on 6 June 2024. Hruby said the paper in Science, and a subsequent debate between the authors the wider nuclear community, promoted the NNSA to respond. "Given concerns about climate change coupled with increased energy demand, nuclear energy is poised for growth," she said. "Advanced and small modular reactors (A/SMRs) using HALEU fuel are under active development "NNSA recognises that reactor type, fuel enrichment level, fuel quantity, and fuel form are important factors in evaluating proliferation risks and believes that risk-informed and adaptive approaches to the proliferation challenges inherent in nuclear energy are warranted." She continued: "NNSA has a program to support U.S. A/SMR developers on security- and safeguards-by-design and promotes best practices for nuclear energy deployment by partnering with the International Atomic Energy Agency (IAEA). "With its national laboratories, NNSA has regularly collected data and evaluated HALEU risks, and is currently finalising plans to commission a National Academies report. Although these reports are largely classified, the information is used to inform programs, develop actions, and make recommendations to stakeholders. "It is important to address proliferation concerns about HALEU and important to responsibly develop A/SMRs. NNSA commits to working with academia, industry, the public, and IAEA to do just that." On 20 January 2025, President Trump will be sworn in for a second term, at which point he will be free to replace public servants with his preferred appointees at organisations including the NNSA. HALEU not being considered in the UK's SMR competition The main focus of SMR developers in the UK is the UK Government's Great British Nuclear (GBN) SMR competition. The competition winner or winners will have the opportunity to build a fleet of SMRs with government support on siting and funding. A GBN source confirmed to NCE that none of the developers in its SMR competition – name the developers – were proposing to use HALEU. NCE has previously explored the topic of whether waste from SMRs could be used to make nuclear warheads after the Department for Energy Security and Net Zero (DESNZ) did not rule out whether it was investigating this possibility. HALEU still popular in wider SMR research Work on SMRs outside of the GBN competition continues to heat up. Last Energy UK and newcleo are both active in the UK and are pushing for micro modular reactors and advanced modular reactors respectively. King's College London research fellow Ross Peel told NCE that **HALEU continues to be popular with SMR developers and the risks faced outside of the USA are similar.** Peel has recently authored papers with King's on Insider Threat Security Considerations for Advanced and Small Modular Reactors and Nuclear Industry Views on the Security of Small Modular Reactors: Results of a pilot survey, both published in October 2024. Peel said he has been "very pro-nuclear" for years but **is working to help the industry to address his security concerns around SMRs, which he believes is "not where it should be".** Peel said: "The article in Science caused a major argument when it came out and since, and is still doing so as more people become aware of it. The American Nuclear Society, for instance, prepared a letter to Science denouncing the article and tearing down the methods used by the authors, who are all highly respected non-proliferation scholars. "**HALEU is central to the plans of many developers of novel nuclear technology because of the various benefits it offers. The potential security and proliferation risks are real**, however, and proper consideration needs to be given to these. "**The technical risks of HALEU in the UK and US are not different**, although we do have a different background level of security risk than they do, which means that those technical risks might be experienced and managed in a different way. "Both countries have well-developed nuclear security infrastructure, however, which will help to manage these risks. **A lot of concern from both countries will likely be around the export of HALEU fuel to reactors abroad, in foreign countries with less mature nuclear security and non-proliferation systems**. "**Normalising the possession and use of uranium of up to 20% U-235 means that many states who might concern the US** and/or the UK **will be able to maintain a justifiable position that is that much closer to possessing nuclear weapons, whilst non-state actors** (terrorists, criminals, and even simple disgruntled employees at nuclear sites and more) **will potentially see their way to accessing a type of nuclear material that they could previously almost never imagine getting hold of.** "Developers should be taking seriously the increased security and proliferation risks associated with HALEU use. I would recommend this be considered from the earliest stages of reactor and fuel design – the decision to use HALEU must be based on a full consideration of all factors, including security risk and proliferation risk.

“Technology designers who think about these issues throughout their design process, in an integrated way alongside safety, economics, operability and all the rest, will have the greatest chance of producing well-conceived designs that address risks effectively and produce cost-effective nuclear energy.” Mixed oxide (MOX) fuel is touted by some developers like newcleo as a way of reducing the burden on society of nuclear waste by using it to fuel its own AMR design. newcleo said: “Through an innovative combination of existing and proven technologies, and by reviving a nuclear industry model based on the manufacture and multi-recycling of Mixed Oxide (Mox) fuel, newcleo aims to close the nuclear fuel cycle while safely producing clean, affordable, and practically inexhaustible energy required for low carbon economies.” Peel continued: “MOX is different to HALEU. MOX is about using a mixture of uranium oxide and plutonium oxide to make the fuel (usually – other oxides can creep in too). Almost all nuclear fuel today is uranium oxide. “HALEU is to do specifically with the uranium within the uranium oxide, specifically, how much of it is uranium-235 vs uranium-238. Most reactors today operate with 2-5% uranium-235 within the overall uranium. HALEU is about moving that into a range of up to 19.999% - going to 20% would make it HEU (highly enriched uranium, which is considered to be unacceptable due to weapons-use risks). “So in theory, you could put HALEU into MOX, although no-one has proposed this as the whole point of putting plutonium in there is to replace the need for uranium-235. If you have both plutonium and HALEU in the same fuel you’re effectively doing two complicated and costly processes a bit, rather than focussing on doing one process more.” Anti-proliferation body says lots of **SMRs increases weapons risk** The Nuclear Information Service (NIS) describes itself as “an independent, not-for-profit research organisation” which investigates the UK’s nuclear weapons programme. NIS director David Cullen said: “**This move by the NNSA is a tacit acknowledgement that warnings being raised about the proliferation risks of HALEU are not unfounded**. “I hope that some of the results of their study will be made public so that there is a greater understanding of the dangers, which are just as relevant to the UK as to the US. “We don't know very much about what would be done in the UK to mitigate the risk, as none of the SMR reactor designs have progressed very far in getting regulatory approval. “Only the Rolls-Royce SMR has passed the second stage of the Generic Design Assessment (GDA) process, which means that the Office for Nuclear Regulation have not identified any foundational problems with that design.” GDA allows regulators to assess the safety, security, safeguards and environmental aspects of new reactor designs before site-specific proposals are brought forward. The GDA process assesses new nuclear power plant designs for deployment in the UK, demonstrating they can be built, operated and decommissioned in accordance with the highest standards of safety, security, safeguards and environmental protection. Cullen continued: “The second stage does assess security and safeguards (i.e. measures to prevent clandestine diversion of nuclear material), but only to identify fundamental flaws. “The third stage of the process is much more detailed. I hope the ONR will have an opportunity to draw upon the work the NNSA is undertaking. “Unfortunately, **the industry’s vision for SMRs, where a much larger number of smaller reactors are deployed, substantially complicates both counter-proliferation monitoring and ensuring the security of nuclear material.** “**Design measures** might be able to counter some of the more opportunistic security threats against an individual site, but they **cannot meaningfully guard against the diversion of nuclear material by SMR operators.** “Fundamentally, **a greater number of sites and more material creates more opportunities for bad actors. There is no way to design around this basic fact**.”

The NRC is woefully unprepared

GAO 24 (Government Accountability Office, independent, nonpartisan government agency within the legislative branch that provides auditing, evaluative, and investigative services for the United States Congress, September 2024, “PREVENTING A DIRTY BOMB Nuclear Regulatory Commission Has Not Taken Steps to Address Certain Radiological Security Risks”, GAO, https://www.gao.gov/assets/gao-24-107014.pdf, DOA 3/28/2025) ESR

NRC has not implemented the majority of the **actions** we have **recommended that would reduce the risk of a** radiological disaster resulting from a **dirty bomb**. Specifically, **NRC has not implemented 11 out of 18 actions** we have **recommended since 2012**. These unimplemented recommendations generally fall into two categories. First, NRC has not taken action to consider socioeconomic consequences in its decision-making criteria for determining security requirements for radioactive materials. Second, **NRC has not taken** the majority of the **actions** we have **recommended to strengthen the security of category 3 quantities of radioactive materials**. As stated previously, NRC has not incorporated consideration of the socioeconomic consequences of a dirty bomb into its decision-making when assessing risk for the development of security measures. So that NRC could be better assured its requirements reflect these significant and more likely consequences, in 2019 we recommended that NRC account for socioeconomic consequences in its decision-making regarding security measures for materials that could be used in a dirty bomb.41 **NRC** disagreed and, in its comments on our 2019 report, **stated that the likelihood of a dirty bomb was low and its regulations were sufficient** to provide for the safe and secure use of radioactive materials. Officials we interviewed for this report stated that this remains NRC’s position today and confirmed that NRC does not plan to implement this recommendation.

This leaves reactors vulnerable to exploitation.

Earnhardt et al 21 (Rebecca L Earnhardt, Research Associate with the Nuclear Security program at the Stimson Center. Her research focuses on emerging technology threats to nuclear facilities, adaptation of nuclear security plans in times of crisis, and international nuclear security governance, Brendan Hyatt, nuclear

security intern at the Stimson Center, Nickolas Roth, senior director of Nuclear Materials Security at the Nuclear Threat Initiative and senior research associate at the Project on Managing the Atom at the Harvard Kennedy School's Belfer Center for Science and International Affairs, 14 January 2021, "A threat to confront: far-right extremists and nuclear terrorism", Bulletin of the Atomic Scientists, https://thebulletin.org/2021/01/a-threat-to-confront-far-right-extremists-and-nuclear-terrorism/, DOA 3/28/2025) ESR

Far-right narratives of nuclear terror. **The intersection between violent far-right extremist ideology and catastrophic terrorism goes back decades. In** The Turner Diaries**, a 1978 novel labeled the "bible of the racist right," the protagonists use acts of nuclear terror in service of the creation of a "white world**." Protagonists bomb nuclear installations, seize nuclear weapons, target missiles at New York City and Tel Aviv, and ultimately destroy the Pentagon in a suicidal nuclear attack.[3] **The International Centre for Counterterrorism ties the Diaries to "at least 200 murders and at least 40 terrorist attacks/hate crimes" in the last 40 years**.[4] This includes Timothy **McVeigh's 1995 bombing** of the Alfred P. Murrah Federal Building in Oklahoma City, resulting in the deaths of 168 people.[5] McVeigh, however, is not the only far-right terrorist to be inspired by the Diaries. **In 2011, violent far-right extremist Anders Breivik's terror attacks killed 77 people in Norway. Dozens of pages in his 1,500-page "manifesto" discuss the execution of different acts of nuclear terrorism**.[6] **An increasingly active generation of violent far-right extremist groups and actors have adopted an especially dangerous ideology that is compatible with an act of nuclear terror: accelerationism**.[7] **Violent far-right extremists** who adopt accelerationism **view societal collapse as inevitable and seek to hasten that collapse in service of "total revolution"—the complete destruction of the existing system of governance.**[8] **Violent far-right extremists who adopt accelerationism hope to set off a series of violent chain events, with violence begetting more violence, destabilizing society**.[9] **Indiscriminate, highly destructive acts of terror—like a nuclear attack—are therefore perfect tools to sow chaos and accelerate this societal collapse. In Siege, one of the defining theoretical works of violent far-right accelerationism, author and accelerationist leader James Mason writes that, "[White supremacists] will be the single survivor in a war against the System**, a TOTAL WAR against the System."[10] In a recent act of violent far-right extremist terrorism, Brenton Tarrant, the Australian perpetrator of the 2019 terrorist attack on Christchurch masjidain in New Zealand, wrote about accelerationism in his manifesto.[11] Groups with nuclear interests**. Inspired by the ideas of accelerationism, the modern breed of violent far-right extremism is becoming more destructive, and nuclear weapons certainly fit into this profile of catastrophic violence.** The intention to bring about a cataclysmic clash of civilizations bears resemblance to better known terrorist organizations like Al Qaeda and Aum Shinrikyo, both of which have pursued nuclear weapons. As director of intelligence and counterintelligence at the US Department of Energy, Rolf Mowatt-Larssen, once observed, "Osama bin Ladin has signaled a specific purpose for using WMD in al Qaeda's quest to destroy the global status quo, and to create conditions more conducive to the overthrow of apostate regimes throughout the Islamic world."[12] Like Al-Qaeda, **violent far-right extremists support the creation of a new society that is in line with their own ideology. One of the most notable and violent far-right extremist groups that have adopted accelerationism and operate in the United States is the Atomwaffen Division** (**AWD**).[13] The organization's name translates from German to "**the nuclear weapons division**," indicating that **its members have an explicit interest in nuclear terrorism**. Brandon Russel, a former Florida National Guard member and an AWD co-founder, is one case of an aspiring nuclear terrorist. **A heavily armed Russel and a fellow AWD member were recently arrested while in route to the Turkey Point nuclear power plant**. During the investigation officials found that Russel lived in an apartment with two AWD co-conspirators; in the apartment was a prominently placed copy of the Turner Diaries and a framed photo of Oklahoma City Bomber Timothy McVeigh. The trio stockpiled weapons and explosives with the intent to blow up, among other targets, a nuclear power plant. In their apartment, police found pipe bomb components, traces of the explosive hexamethylene triperoxide diamine, and detonators. Police also detected two radioactive materials—thorium and americium—in his bedroom.[14] **AWD was not the first far-right extremist in America to consider using radioactive or nuclear materials in a terrorist attack. Several previously documented attempts by violent far-right extremists to commit acts of radiological terror indicate a longstanding interest among far-right actors in highly destructive, non-conventional acts of terror**.[15] In 2004, National Socialist Movement member Demetrius **Van Crocker attempted to build a dirty bomb to blow up a courthouse**.[16] In 2008, James **Cummings, a white supremacist, obtained four 1-gallon containers of a mix of depleted uranium and thorium-232. He planned to use these materials to assemble a dirty bomb**.[17] In 2013, a member of the Ku Klux Klan who worked at General Electric carried out research on radiation dispersal devices, learning what level of emission was required to kill humans.[18]

A successful nuclear attack triggers war.

Hayes 18 (Peter Hayes is Director of the Nautilus Institute and Honorary Professor at the Centre for International Security Studies at the University of Sydney. “NON-STATE TERRORISM AND INADVERTENT NUCLEAR WAR,” *Nautilus Institute*, 1/18/18, https://nautilus.org/napsnet/napsnet-special-reports/non-state-terrorism-and-inadvertent-nuclear-war/) dwc 18

Conclusion We now move to our conclusion. Nuclear-armed states can place themselves on the edge of nuclear war by a combination of threatening force deployments and threat rhetoric. Statements by US and North Korea’s leaders and supporting amplification by state and private media to present just such a lethal combination. Many observers have observed that the risk of war and nuclear war, in Korea and globally, have increased in the last few years—although no-one can say with authority by how much and exactly for what reasons.//// However, states are restrained in their actual decisions to escalate to conflict and/or nuclear war by conventional deterrence, vital national interests, and other institutional and political restraints, both domestic and international. It is not easy, in the real world, or even in fiction, to start nuclear wars.[19] Rhetorical threats are standard fare in realist and constructivist accounts of inter-state nuclear deterrence, compellence, and reassurance, and are not cause for alarm per se. States will manage the risk in each of the threat relationships with other nuclear armed states to stay back from the brink, let alone go over it, as they have in the past. //// This argument was powerful and to many, persuasive during the Cold War although it does not deny the hair-raising risks taken by nuclear armed states during this period. Today, the multi-polarity of nine nuclear weapons states interacting in a four-tiered nuclear threat system means that the practice of sustaining nuclear threat and preparing for nuclear war is no longer merely complicated, but is now enormously complex in ways that may exceed the capacity of some and perhaps all states to manage, even without the emergence of a fifth tier of non-state actors to add further unpredictability to how this system works in practice. //// The possibility that **non-state actors** may **attack without advance warning** as to the time, place, and angle of attack presents another layer of uncertainty to this complexity as to how inter-state nuclear war may break out. That is, non-state actors with nuclear weapons or threat goals and capacities do not seek the same goals, will not use the same control systems, **and** will **use** radically **different organizational procedures** and systems to deliver on their threats compared with nuclear armed states. If used tactically for immediate terrorist effect, a non-state **nuclear terrorist could** violently attack nuclear facilities, exploiting any number of vulnerabilities in fuel cycle facility security, or **use actual nuclear** materials and even **warheads against** military or civilian **targets**. If a persistent, strategically oriented nuclear terrorist succeed in gaining credible nuclear threat capacities, it might take hostage one or more states or cities.//// If such an event coincides with already high levels of tension and even military collisions between the non-nuclear forces of nuclear armed states, then a non-state nuclear terrorist attack could **impel a nuclear** armed **state to escalate** its threat or even military actions **against other states, in the belief** that **this** targeted **state** may have **sponsored the non-state attack**, or was simply the source of the attack, whatever the declared identity of the attacking non-state entity. **This**outcome could **trigger** these states to go onto one or more of the pathways to inadvertent **nuclear war**, especially if the terrorist attack was on a high value and high risk nuclear facility or involved the seizure and/or use of fissile material. //// Some experts dismiss this possibility as so remote as to be not worth worrying about. Yet the history of nuclear terrorism globally and in the Northeast Asian region suggests otherwise. Using the sand castle metaphor, once built on the high tide line, sand castles may withstand the wind but eventually succumb to the tide once it reaches the castle—at least once, usually twice a day. Also, theories of organizational and technological failure point to the coincidence of multiple, relatively insignificant driving events that interact or accumulate in ways that lead the “metasystem” to fail, even if each individual component of a system works perfectly. Thus, the potential catalytic effect of a nuclear terrorist incident is not that it would of itself lead to a sudden inter-state nuclear war; but that at a time of crisis **when alert levels are** already **high**, when control systems on nuclear forces have already shifted from primary emphasis on negative to positive control, when **decision making is** already **stressed**, when **the potential for miscalc**ulation **is** already **high** due to shows of force indicating that first-use is nigh, when **rhetorical threats promising annihilation** on the one hand, or collapse of morale and weakness on the other **invite counter-vailing threats by nuclear adversaries or their allies** to gain the upper hand **in the “contest of resolve**,” and when organizational cybernetics may be in play such that purposeful actions are implemented differently than intended, **then a terrorist nuclear attack** may **shift** a coincident combination of some or all of these factors **to a threshold level where they** collectively **lead to** a **first-use decision** by one or more nuclear-armed states. If the terrorist attack is timed or happens to coincide with high levels of inter-state tension involving nuclear-armed states, then some or all of these tendencies will likely be in play anyway—precisely the concern of those who posit pathways to inadvertent nuclear war as outlined in section 2 above. //// The critical question is, just as a catalyst breaks some bonds and lets other bonds form, reducing the energy cost and time taken to achieve a chemical reaction, how would a nuclear terrorist attack at time of nuclear charged inter-state tension potentially shift the way that nuclear threat is projected and perceived in a four or five-way nuclear-prone conflict, and how might it affect the potential pathways to inadvertent nuclear war in such a system?//// Such a pervasive incremental effect is shown in Figure 6 below. Figure 6: Impact of a Terrorist Nuclear Threat or Attack on Interstate Nuclear Use Control //// Any one or indeed all of these starting nuclear control profiles may be disputed, as might the control profile at the end of the response arrow. (In Figure 6, each nuclear state responds to a terrorist nuclear attack by loosening or abandoning negative controls against unauthorized use, and shifts towards reliance mostly on positive procedural controls biased towards use). But each nuclear armed state will make its moves in response to the posited terrorist nuclear attack partly in response to its expectations as to how other nuclear armed states will perceive and respond to these moves, as well as their perception that an enemy state may have sponsored a terrorist nuclear attack—and considered together, it is obvious that they may not share a common image of the other states’ motivations and actions in this response, leading to cumulative potential for misinterpretation and rapid subsequent action, reaction, and escalation.

A2 Subs

1. Investment now, Nikolov from April

Boyko Nikolov (journalist and political analyst at the Bulgarian Military Industry Review), 4-10-2025, "U.S. Navy's submarine fleet faces supply chain crisis in 2025", Bulgarian Military Industry Review, https://bulgarianmilitary.com/2025/04/10/u-s-navys-submarine-fleet-faces-supply-chain-crisis-in-2025//EEdoa04/13/25

The drive to increase production is no small feat, especially given the intricate engineering demands of these vessels. The Columbia-class submarines, designed to replace the aging Ohio-class fleet, represent the Navy's top priority for maintaining its nuclear deterrence. These behemoths stretch 560 feet long, displace 20,806 tons when submerged, and are engineered to carry 16 Trident II D5 ballistic missiles—each capable of delivering multiple nuclear warheads over a range exceeding 7,400 miles. Their electric-drive propulsion system, a leap forward from traditional mechanical drives, promises enhanced stealth, allowing them to glide silently beneath the waves for decades without refueling. The Navy plans to build 12 of these submarines, with the lead boat, USS District of Columbia [SSBN-826], already under construction since 2021 and slated for delivery by 2030, though delays have pushed that timeline into question. Meanwhile, the Virginia-class submarines are the Navy's multi-role workhorses, built for everything from hunting enemy subs to launching Tomahawk cruise missiles against land targets. Measuring 377 feet and displacing 7,800 tons, these fast-attack subs feature advanced sonar arrays, like the Large Aperture Bow system, and can carry up to 38 weapons, including torpedoes and missiles housed in vertical launch tubes. Since their introduction in 1998, 40 Virginia-class boats have been ordered, with production hovering around two per year since 2011. The Navy now wants to sustain that pace while adding the Columbia-class to the mix—a combined effort dubbed the "1+2" procurement rate. Achieving this, however, requires shipyards to overcome significant obstacles, from **workforce shortages to cutting-edge manufacturing demands.** At General Dynamics Electric Boat in Groton, Connecticut, and Newport News Shipbuilding in Virginia, the push is on to adapt facilities for this dual-track production. Electric Boat, the prime contractor for both programs, has poured resources into expanding its workforce, hiring thousands in recent years to meet demand. In a March 2025 statement, company president Mark Rayha emphasized the need for sustained investment, saying, "**This contract modification drives continuation of the crucial demand signal that the submarine industrial base needs to invest in the capacity and materials required to increase production volume,"** as reported by GovCon Wire. Newport News, a division of Huntington Ingalls Industries, complements this effort by constructing key sections of both submarine classes, splitting the workload to keep pace. Yet, despite these efforts, t**he Government Accountability Office noted in late 2024 that production rates for Virginia-class subs remain stuck at 1.2 boats per year, well below the desired two—a gap that threatens to widen as Columbia-class construction ramps up.** Technology is a double-edged sword in this endeavor. On one hand, innovations like robotic welding and modular construction—where massive submarine sections are built separately and then assembled—have streamlined processes that once took years of manual labor. Electric Boat has also explored 3D printing for smaller components, reducing lead times for parts that would otherwise bottleneck production. Artificial intelligence is creeping into supply chain management, too, helping predict shortages and optimize logistics across a sprawling network of suppliers. **But these advancements come with challenges. The Columbia-class's electric-drive system, for instance, relies on massive turbine generators that have faced delays, with delivery setbacks reported by the GAO pushing key milestones into 2025.** Integrating such complex systems into a hull designed to operate undetected for 42 years demands precision that even the most advanced tools can't always guarantee. Workforce issues compound these technical hurdles. The submarine industry requires highly skilled welders, machinists, and engineers—jobs that take years to master. Post-pandemic labor shortages, coupled with an aging workforce, have left shipyards scrambling.

In 2025, Electric Boat reported hiring over 4,000 workers in a single year, yet retention remains a struggle as younger generations shy away from industrial trades. The Navy and industry have partnered on initiatives like the Submarine Industrial Base Workforce Development Program, launched in 2023, to train new talent, but scaling up fast enough to meet the "1+2" target remains uncertain. A Congressional Research Service report from March 2025 warned, "Whether strategic outsourcing and SIB funding will be enough to increase the Virginia-class production rate to 2.0 boats per year by 2028… is uncertain," highlighting the precarious balance between ambition and reality. **Beyond the shipyards, the supply chain emerges as a critical vulnerability.** Building these submarines **requires rare materials like titanium and high-strength steel, sourced from a global market where competition is fierce**. 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Submarines have long been the Navy's ace in the hole, offering unmatched stealth and firepower. The Virginia class, with its ability to loiter undetected off hostile coasts, can disrupt enemy shipping or strike inland targets with precision. In the South China Sea, where China's navy has expanded aggressively, additional Virginia boats could tip the balance, shadowing Beijing's growing fleet of Type 096 submarines—nuclear-armed vessels estimated to displace 11,000 tons and carry 24 ballistic missiles. The Columbia-class, meanwhile, ensures the U.S. retains a credible nuclear deterrent, particularly in the Arctic, where melting ice has opened new routes for Russian Yasen-class subs, stealthy attackers with a 9,100-ton displacement and hypersonic missile capabilities. Historically, submarines have shaped naval power. 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If successful, it could cement U.S. undersea dominance for decades, countering China's rise and Russia's resurgence. The technological leaps—electric drives, AI logistics, modular builds—signal a new era of naval engineering, while the operational payoff could deter aggression in flashpoints like Taiwan or the Arctic. Yet the risks are real. Supply chain fragility, workforce gaps, and ballooning costs threaten to derail the effort, potentially leaving the Navy outgunned in a

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2. Litany of alt problems the aff doesn;t solve, Nikolov '25

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In 2025, **China controls vast swathes** of rare earth elements vital for advanced electronics, while Russia remains a key supplier of titanium—a metal prized for its strength and corrosion resistance in submarine hulls. The U.S. has moved to secure domestic sources, with the Department of Defense investing in mining projects in states like Texas and Nevada, but these efforts are years from fruition. A January 2025 report from the Center for Strategic and International Studies n**oted that supply chain disruptions, exacerbated by geopolitical tensions, could delay submarine construction by months or even years if key materials dry up. Worse still, the reliance on a handful of specialized suppliers—some overseas—creates targets for cyberattacks, a threat the Pentagon has flagged as a growing concern since breaches hit defense contractors in 2023.** The stakes of this production surge extend far beyond factory floors, directly impacting America's ability to wage underwater war. 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3. Detection tech makes sub deterrence obsolete.

Roger Bradbury (Emeritus Professor of Complex Systems Science, Crawford School of Public Policy, Australian National University) , 3-13-2023, "Progress in detection tech could render submarines useless by the 2050s. What does it mean for the AUKUS pact?," Conversation, https://theconversation.com/progress-in-detection-tech-could-render-submarines-useless-by-the-2050s-what-does-it-mean-for-the-aukus-pact-201187, accessed 4-13-2025 //RP

Speaking at a summit in San Diego on Monday, Prime Minister Anthony Albanese has announced a decades-long strategy to deliver the most costly defence project in Australia's history. New details of the AUKUS defence and security pact have revealed Australia will buy three second-hand US Virginia-class submarines early next decade (and potentially two more), subject to approval by US Congress. Australia will also build a fleet of eight nuclear-powered SSN-AUKUS boats at Adelaide's Osborne Naval Shipyard. The first will be delivered by 2042, with five completed by the 2050s, and construction of the remaining three going into the 2060s. It's estimated the program will cost between A$268 billion and A$368 billion over the next three decades. Make no mistake. **Modern submarines, especially nuclear-powered ones, are one of the most potent and effective weapon systems in today's world. That is, until they aren't. Our analysis shows they might soon be so easily detected they could become billion-dollar coffins**. Learn about the latest, most interesting health and science research Get the newsletter The rise in detection technologies Both the greatest strength and greatest weakness of subs is their stealth. The best are fiendishly difficult to detect. They can be nearly anywhere in the vast expanse of the world's oceans, so adversaries must protect against them everywhere. **But if subs can be detected, they become easy targets: large, slow-moving and vulnerable to attack from the surface.** Historically, submarines have provided a distinct advantage: their stealth is the result of steady improvements in counter-detection technologies throughout the Cold War. Western submarines in particular are extremely quiet. Detection technologies, which mostly focused on sound, broadly struggled to keep up. But this tide is turning. **Subs in the ocean are large, metallic anomalies that move in the upper portion of the water column. They produce more than sound. As they pass through the water, they disturb it and change its physical, chemical and biological signatures. They even disturb Earth's magnetic field – and nuclear subs unavoidably emit radiation. Science is learning to detect all these changes, to the point where the oceans of tomorrow may become "transparent". The submarine era could follow the battleship era and fade into history.**

4. The root cause of Columbia sub delays is lack of REM's, investment doesn't solve.

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The Navy and industry have partnered on initiatives like the Submarine Industrial Base Workforce Development Program, launched in 2023, to train new talent, but scaling up fast enough to meet the "1+2" target remains uncertain. A Congressional Research Service report from March 2025 warned, "Whether strategic outsourcing and SIB funding will be enough to increase the Virginia-class production rate to 2.0 boats per year by 2028… is uncertain," highlighting the precarious balance between ambition and reality. **Beyond the shipyards, the supply chain emerges as a critical vulnerability.** Building these submarines **requires rare materials like titanium and high-strength steel, sourced from a global market where competition is fierce**. In 2025, **China controls vast swathes** of rare earth elements vital for advanced electronics, while Russia remains a key supplier of titanium—a metal prized for its strength and corrosion resistance in submarine hulls. The U.S. has moved to secure domestic sources, with the Department of Defense investing in mining projects in states like Texas and Nevada, but these efforts are years from fruition. A January 2025 report from the Center for Strategic and International Studies n**oted that supply chain disruptions, exacerbated by geopolitical tensions, could delay submarine construction by months or even years if key materials dry up. Worse still, the reliance on a handful of specialized suppliers—some overseas—creates targets for cyberattacks, a threat the Pentagon has flagged as a growing concern since breaches hit defense contractors in 2023.** The stakes of this production surge extend far beyond factory floors, directly impacting America's ability to wage underwater war. Submarines have long been the Navy's ace in the hole, offering unmatched stealth and firepower. The Virginia class, with its

ability to loiter undetected off hostile coasts, can disrupt enemy shipping or strike inland targets with precision. In the South China Sea, where China's navy has expanded aggressively, additional Virginia boats could tip the balance, shadowing Beijing's growing fleet of Type 096 submarines—nuclear-armed vessels estimated to displace 11,000 tons and carry 24 ballistic missiles. The Columbia-class, meanwhile, ensures the U.S. retains a credible nuclear deterrent, particularly in the Arctic, where melting ice has opened new routes for Russian Yasen-class subs, stealthy attackers with a 9,100-ton displacement and hypersonic missile capabilities. Historically, submarines have shaped naval power. During the Cold War, Ohio-class boats armed with Trident missiles formed the backbone of America's nuclear triad, while Los Angeles-class attack subs hunted Soviet counterparts beneath the Atlantic. Today's underwater battlefield is more complex, with adversaries fielding advanced sonar, underwater drones, and anti-submarine aircraft. The Virginia class counters this with acoustic quieting—its pump-jet propulsors reduce noise to near-ambient levels—while the Columbia class's 42-year lifespan ensures it can outlast emerging threats. Compared to Russia's Yasen, which boasts greater speed [35 knots submerged], or China's Type 095, a quieter but less armed attack sub, the U.S. designs prioritize versatility and endurance, traits that could prove decisive in a prolonged conflict. Globally, America's rivals aren't standing still. China's submarine fleet, numbering over 60 boats by 2025 according to the Office of Naval Intelligence, includes the Yuan-class, a diesel-electric sub with air-independent propulsion that rivals the Virginia's stealth in coastal waters. Beijing has accelerated construction at its Bohai Shipyard, aiming for a fleet of 80 subs by 2035. Russia, meanwhile, has prioritized quality over quantity, with its Yasen-M variant entering service in 2024, armed with Zircon missiles that travel at Mach 9. There's chatter in defense circles—unconfirmed but persistent—that Moscow might share submarine tech with North Korea, whose own Sinpo-class boats could soon carry ballistic missiles. Iran, too, has bolstered its underwater presence with domestically built Fateh-class subs, though they lag far behind in sophistication. Back in the U.S., the Navy's push has sparked debate. Funding for the "1+2" plan is substantial—$3.36 billion for the Columbia class and $3.615 billion for the Virginia class in Fiscal Year 2025, per a March continuing resolution reported by USNI News. Yet critics, including some in Congress, question whether shipyards can deliver. The Columbia program alone has ballooned to $348 billion over its lifetime, per a 2025 19FortyFive estimate, with delays risking a gap in nuclear deterrence as Ohio-class boats retire. The AUKUS pact, which promises Australia three to five Virginia-class subs in the 2030s, adds further strain, with skeptics arguing the U.S. can't spare boats while its own fleet shrinks to 50 attack subs by 2030, down from 66 in 2015. What does this all mean for the future? The Navy's submarine surge is a bold bid to stay ahead in a domain where stealth and power reign supreme. If successful, it could cement U.S. undersea dominance for decades, countering China's rise and Russia's resurgence. The technological leaps—electric drives, AI logistics, modular builds—signal a new era of naval engineering, while the operational payoff could deter aggression in flashpoints like Taiwan or the Arctic. Yet the risks are real. Supply chain fragility, workforce gaps, and ballooning costs threaten to derail the effort, potentially leaving the Navy outgunned in a theater it has long ruled. As autonomous drones and hypersonic weapons redefine underwater combat, one question lingers: Can America's industrial might keep pace with its strategic ambitions, or will this be a high-stakes gamble that falls short beneath the waves?

5. Supplier delays independently deck the timeline. Shelbourne '24

Mallory Shelbourne (Mallory Shelbourne is a reporter for USNI News. She previously covered the Navy for Inside Defense and reported on politics for The Hill), 3-11-2024, "Supplier Problems Put Columbia Nuclear Missile Sub at Risk for 1-Year Delay," USNI News, https://news.usni.org/2024/03/11/first-columbia-nuclear-missile-sub-at-risk-of-1-year-delay-due-to-supplier-problems, accessed 4-13-2025 //RP

THE PENTAGON – **The lead ship in the Columbia-class ballistic missile submarine program is facing a potential one-year delay due to supplier issues**, putting the Navy's number one acquisition program at risk and creating a potential gap in the U.S. nuclear strategic deterrent, five people familiar with the delay told USNI News. The future USS District of Columbia (SSBN-826) could deliver in Fiscal Year 2028 instead of its planned FY 2027 delivery, the sources confirmed to USNI News. Capitol Forum first reported news of the delay on Monday. **The largest hurdle for District of Columbia is the bow module of the submarine that is under construction at HII's Newport News Shipbuilding in Virginia, two sources**

familiar with the delay told USNI News. The overall program is facing additional delays from the steam turbines that Northrop Grumman is under contract to build for the Navy. Under the teaming arrangement for the Columbia program, lead contractor General Dynamics Electric Boat assembles the central barrel of the submarine's hull at its yard in Groton, Conn., and its manufacturing facility in Quonset Point, R.I. Those modules built in New England are married to bow and stern sections that are constructed at Newport News and sent by barge up to the Columbia assembly hall in Connecticut. **HII has been late in delivering the sections, delaying the timeline for construction. Newport News delivered the stern of the lead boat in January, USNI News previously reported**. Likewise, the turbines that translate the steam generated by the submarine's nuclear reactor to mechanical and electrical energy have also hit manufacturing delays, causing blockages in production. A spokesman for HII's Newport News referred USNI News to General Dynamics Electric Boat when asked about the potential schedule slippage. A spokesman for General Dynamics referred USNI News to the Navy. **Asked about the initial report during the Navy's Fiscal Year 2025 budget briefing on Monday, Under Secretary Erik Raven pointed to Secretary Carlos Del Toro's 45-day shipbuilding review. "We're seeing stress across the industrial base and again I think putting this in the context of the Secretary's 45-day review will add additional depth and context to the challenges that we're seeing across the shipbuilding portfolio and we expect to have that done fairly soon,"** Raven told USNI News.

6. Russia's fleet is a mess

Kass 24 – Harrison Kass is a defense and national security writer with over 1,000 total pieces on issues involving global affairs. Harrison holds a BA from Lake Forest College, a JD from the University of Oregon, and an MA from New York University, 7-5-2024, "The Russian Navy's Submarine Fleet Is a Total Mess", https://nationalinterest.org/blog/buzz/russian-navys-submarine-fleet-total-mess-211748

The Russo-Ukraine War has laid bare the shortcomings of the Russian military. Shoddy equipment and procedures have hampered Putin's invasion.

But the signs of decay were evident for years.. In September 2013, a fire erupted during the installation of the main ballast tank of the K-150 Tomsk submarine.

Installing a ballast tank should have been a routine and safe procedure, performed without incident or injury. But a spark in the insulating materials started the conflagration. By the time the fire was beaten, 15 sailors were injured, and the K-150 was out of commission, in need of repairs that would take several months to complete.

The K-150 was hardly an isolated incident. Seven major submarine accidents hit the Russian fleet between 2000 and 2015, many of them involving nuclear-powered and/or armed submarines, raising the specter of nuclear disaster.

Problems with the fleet

"There is a continuing problem with Russia's fleet," said Paul Schwartz, a senior associate at CSIS. "They are certainly going to continue to have problems until they can really upgrade their fleet and phase out or substantially upgrade [submarines] with [outdated] components and systems."

In 2015, the K-266 *Orel* was undergoing a refit while dry-docked, and, in an incident reminiscent of the K-150 fire, the K-266's insulation ignited during a welding job. The dock had to be flooded to contain the fire – another disaster resulting from what should have been a very routine maintenance gig.

The fires aboard the K-150 and K-266 were minor relative to the sinking of the *Kursk*, however. In 2000, the Kursk, an Oscar II-class submarine, sank in the Barents Sea when the sub's torpedo warheads exploded. All 118 sailors aboard were killed – but not immediately. Twenty-three sailors survived for several days in the stern of the submarine. Russia failed to provide assistance, though, allowing the sailors to perish slowly. The international community of course criticized Russia for allowing their sailors to die – and for the fleet's abysmal safety record.

Russia's submarine fleet has dwindled significantly from its Cold War heyday. The fleet once comprised hundreds of submarines, but in 2007 it numberedjust 65, many of which had catastrophic problems. Clearly, the Russian submarine fleet is in decline.

"A lack of maintenance and procurement of quality systems has and will continue to hurt Russia's submarine fleet for the next 10 to 15 years," Schwartz said, emphasizing that today, the problem is "not something you can just throw money at" and that "there is going to be a window of time where Russian submarines are going to have a significantly higher rate of accidents and issues than, say, the U.S. fleet, which is maintained at a much higher level."

7. The US is far ahead and still going --- investment is inevitable.

Dibb 24 [Paul Dibb and Richard Brabin-Smith, both former deputy secretaries of defence. 4-26-2024, "Why the US will stay dominant in undersea warfare", Strategist, https://www.aspistrategist.org.au/why-the-us-will-stay-dominant-in-undersea-warfare/, doa 3-28-2025] //ALuo

A number of commentators in Australia have lately made rash pronouncements about the demise of US submarines, alleging that innovative technologies will make the vessels vulnerable. Others have been arguing that US nuclear-powered submarines are now noisier than their Chinese counterparts and will be easily detectable by China. The fact is that the United States has been **so far ahead** in **submarine technology** and **secure underwater operations** over the past 50-plus years that its submarines are virtually **undetectable** by either China or Russia. In the Cold War, US attack submarines (SSNs) tailed Soviet ballistic–missile firing submarines (SSBNs) at close quarters without being detected. There is every reason to believe that the same applies these days to China's SSBNs. It is our view that China's SSBNs are so easily tracked by US SSNs that China's allegedly survivable second-strike nuclear capability is at high risk (as was that of the USSR in the Cold War). In brief, the quietness of US submarines and the sophistication of their operations are legendary. The reason for this is that for more than half a century the United States has **persistently poured vast amounts** of **research and development** into **superior underwater warfare technology**. Naturally, these capabilities are among the United States' most highly guarded secrets, so little information about them is in the public domain. However, we recommend two books: Blind Man's Bluff by Sherry Sontag and Christopher Drew (1998) and The Silent Deep: The Royal Navy Submarine Service since 1945 by Peter Hennessy and James Jinks (2016). The former is about highly classified US submarine operations involving the CIA tapping into the USSR's seabed communications in the sea of Okhotsk for the Soviet Pacific submarine fleet in Kamchatka. US submarines made repeated visits and were not detected. The Silent Deep covers close–quarter submarine operations against Soviet SSBNs and SSNs by British nuclear submarines, whose reputation is similar to US submarines'. To our knowledge, there is no equivalent book available about operations against China's submarines yet (but the subject is touched on by Michael McDevitt's China as a Twenty First Century Naval Power, 2020). Those who talk about **superior Chinese submarine operations** being able **easily to detect US submarines do not know what they are talking about**. The fact is that until recently China has **depended very much** on **Russian technology** for its SSBNs and SSNs. That includes **even such relatively straightforward techniques** as isolating the noise of engines and other machinery from the hull. We need to remember that in the Cold War Soviet ballistic–missile firing submarines were known as **boomers** because their loud noises were **detectable over very considerable distances**. As for China dealing with US submarines, the Pentagon stated in 2023 that China '**continues to lack a robust deep-water anti-submarine warfare capability**.' It is true, of course, that both Russia and China are making progress towards quieter submarine operations. But do we believe that the United States is sitting on its hands and making no technological advances? **Of course not**. The US Navy continues to **invest huge amounts** in ensuring that its submarines remain at the **absolute forefront** of hard-to-detect operations under the world's oceans. So, when we take delivery of our three Virginia–class SSNs from the US, we can be confident that they will be both highly effective and difficult to counter. This is why China is so angry about the prospect of our acquiring them. China already has a bad case of SLOC anxiety (worrying about its sea lines of communication). It fears loss of critical supplies, such as oil, that come through the confined waters of Southeast Asia.

A2 Heg

1. NL - Trump thumps.

Schuman 25 [Michael Schuman, nonresident senior fellow in the Atlantic Council's Global China Hub, 2-18-2025, Trump Hands the World to China, Atlantic, https://www.theatlantic.com/international/archive/2025/02/foreign-policy-mistake-china/681732/, Willie T.]

American global leadership is ending. Not because of "American decline," or the emergence of a multipolar world, or the actions of U.S. adversaries. It's ending because President Donald Trump **wants to** end it.

Just about all of Trump's policies, both at home and abroad, are **rapidly destroying** the foundation of American power. The main beneficiary will be the Chinese leader Xi Jinping, who has been planning for the moment when Washington stumbles and allows China to replace the United States as the world's superpower. That Trump is willing to hand the world over to Xi—or doesn't even realize that's what he's doing—shows that his **myopic worldview**, **admiration for autocrats**, and **self-obsession** are combining to threaten international security and, with it, America's future.

Trump is choosing to retreat even though the U.S. has its adversaries on the back foot. President Joe Biden's foreign policy was working. By supporting Ukraine's defense against Russia's invasion, Biden weakened Moscow so severely that President Vladimir Putin had to turn to North Korea for help. His backing of Israel in its war with Hamas in Gaza undercut Iran's influence in the Middle

East. And Biden's strengthening of the U.S. global-alliance system pressured and unnerved China as the world's advanced democracies banded together against Xi and his plans to upset the world order.

Now Trump is voluntarily **throwing away** this hard-won leverage. The supposed master negotiator is signaling his **willingness to sacrifice Ukraine** to Russia before formal negotiations even start. Last week, U.S. Defense Secretary Pete Hegseth called a restoration of Ukraine to its borders before Russia snatched Crimea in 2014 an "unrealistic objective," indicating that the administration would accept a peace deal that allows Putin to keep part of the independent nation he invaded. Hegseth also rejected NATO membership for Ukraine—the possibility of which was Putin's pretext for invading in the first place. That wouldn't be a bad outcome for Putin after starting a brutal war and effectively losing it.

But the big winner from such a settlement will be China. Because China is Russia's most important partner, any gains that Putin can salvage from his disastrous war forwards the two dictators' global agenda. That's why Xi is egging Trump on. Beijing has reportedly proposed holding a summit between Trump and Putin to resolve the Ukraine war. Then Chinese construction companies would try to swoop in and earn a fortune rebuilding a shattered Ukraine, which Xi helped Putin destroy by supporting Russia's sanctions-plagued economy.

More than that, Xi certainly realizes that Trump's **pandering** to Putin offers Xi a chance to break up the Atlantic alliance and **entrench Chinese influence** in Europe. Vice President J. D. Vance **blasted European allies** at last week's Munich Security Conference for marginalizing extremist right-wing political parties, and Chinese Foreign Minister Wang Yi took the opportunity to present Xi as the anti-Trump. "China will surely be a factor of certainty in this multipolar system and strive to be a steadfast constructive force in a changing world," he told the attendees.

European leaders are not likely to have forgotten that Xi enabled Putin's war in Ukraine. But if Trump won't guarantee European security, Xi may well seize the opportunity to **expand Chinese power** by offering to step into the breach. Xi could make the case that he is able to rein in Putin, protect Ukraine, and preserve stability in Europe. That promise could well be an empty one; Xi may not be willing or even able to restrain an emboldened Putin. Still, abandoned by Washington, European leaders may hold their collective noses and look to Xi to keep the peace.

China "would start replacing the U.S. in the role of keeping Russia out of the Eastern Flank," Gabrielius Landsbergis, the former Lithuanian foreign minister, recently posted on X. European Union members "in the East would be dependent on China's protection and the racketeering would spread West."

Trump is handing Xi other opportunities, too. By withdrawing from the World Health Organization and the **U**nited **N**ations **H**uman **R**ights **C**ouncil, the U.S. is clearing the field for China to make the UN system an **instrument of its global power**. **Dismantling USAID** makes China all the more **indispensable** to the developing world. Trump's bizarre plan to deport Palestinians from Gaza will be a boon to Xi in the Middle East, a region China considers vital to its interests. Even the U.S. suspension of federal financial support for electric vehicles helps Xi by hampering American automakers in a sector Beijing seeks to dominate. China may see American retrenchment as an invitation to take more aggressive actions in pursuit of its interests—in Taiwan, but also toward other U.S. allies in Asia, including Japan, South Korea, and the Philippines.

Trump apparently assumes that he can keep Xi in check with tariffs. He imposed new duties on Chinese imports earlier this month. But Xi doesn't seem particularly bothered. Beijing retaliated, but with little more than a face-saving gesture. The reciprocal tariffs covered a mere tenth of U.S. imports. Why fuss about a few shipments of stuffed toys when you can take over the world?

The damage to American global standing could be **irreparable**. The hope now is that the major democracies of Europe and Asia—France, Germany, Italy, Japan, and the United Kingdom—will stop up the power vacuum Trump is creating and keep China out of it. European leaders do not have to abide by whatever deal Trump cooks up with Putin for Ukraine. They could hold firm, continue the war, and wait for a new administration in Washington to reaffirm U.S. security commitments. But the course is risky, because erstwhile U.S. allies can't

assume that Washington will ever reestablish global leadership, or that if it does, the promises of future presidents will endure. That uncertainty may compel the allied democracies to make accommodations with China as best they can.

Trump's administration may be seeking to settle matters with Putin in order then to concentrate limited U.S. resources on confronting China. But this course may succeed only in making China more difficult to contend with, because America will be forced to do so without its traditional allies by its side.

Trust, once lost, is **difficult to restore**. Trump's premise seems to be that what happens in Europe and Asia is of little consequence to the United States. Vance invoked Catholic theology (erroneously, according to Pope Francis) to justify a hierarchy of concern that places caring for U.S. citizens ahead of the rest of the world. But what, exactly, is best for Americans?

Trump may be right that other powers should do more to take care of their own affairs. But Americans know as well as anyone that what happens in the far-flung corners of the world—whether in Europe in the 1930s and '40s or in Afghanistan at the turn of the 21st century—can and often does affect them, even dragging them into **conflicts** they do not want to fight. That doesn't mean Washington must police every dispute. But by ceding global leadership to authoritarian China, Trump is creating a world that will almost certainly be **hostile to the United States**, its prosperity, and its people.

2. US LAWS decks solvency

Freeman 18 [Madison Freeman, research associate @ Council on Foreign Relations. 7-12-2018, "How Russia, China Use Nuclear Reactors To Win Global Influence", Defense One, https://www.defenseone.com/ideas/2018/07/china-and-russia-look-dominate-global-nuclear-power/149642/, doa 3-9-2025] //ALuo

In addition, U.S. nuclear exports are **severely limited** by **restrictive export laws** and an **inefficient and complicated export control process.** While maintaining nonproliferation standards is critical to safeguarding global peace, the **stringent conditions** of these agreements and export controls make U.S. technology **far less appealing** to other countries than technology from Russia or China, which comes with **fewer strings attached**. Creating hurdles for U.S. exports will not prevent the adoption of nuclear technology by interested countries, but it will **remove the United States** from a role in which it can help **guide the development** of nuclear power and monitor for proliferation concerns.

3. China exports of nuclear material is down.

a. Debt Traps+Domestic discontent

Dialogo 23, citing and quoting Luis Fleischman, PhD, Professor of Political Science at Palm Beach State University in Florida (Julietta Dialogo, August 16, 2023, "China Wants to Control the Latin American Electricity Sector," Americas, https://dialogo-americas.com/articles/china-wants-to-control-the-latin-american-electricity-sector/)

China's strategy in **Latin America** is clear: "**to own the light**," Latinoamérica 21 reported. According to BBC Mundo, Beijing has invested large **sums** of money to acquire consolidated **assets** instead of building from scratch, taking

advantage of the exit of European **companies** and the decline of companies linked to the Lava Jato (Car Wash) scandal, a corruption case with multiple ramifications that in recent years has involved prominent public figures in Brazil and which had Petróleos do Brasil as one of its epicenters. Chinese companies and policy banks back **648** overseas power **plants**, representing 1,423 individual power generating units, providing a total of 171.6 gigawatts of power generation capacity in 92 countries, the BU indicated. According to its data, Chinese firms made **inroads** into Brazil's electricity sector with 114 **merger** and acquisitions and **debt** financing projects. They also carried out 10 deals in Chile and Mexico respectively, three in Peru and two in Ecuador. Between 2017 and 2021, China acquired 71 percent of companies in Latin America, for a total of $44.4 billion, Latinoamérica 21 reported. China's control in the region stands out compared to other corporations' investment in the electricity sector, which reaches only 7 percent. China seeks control through "soft power**" to make other countries dependent**. The projects under the Belt and Road Initiative give Beijing strategic and political advantages, Latinoamérica 21 added. CSGI-Enel Peru Italian energy group Enel announced in April that its subsidiary Enel Peru agreed to sell its stake in two energy assets to China Southern Power Grid International (CSGI), which represents a concentration of the electricity distribution market in the city of Lima, Peruvian newspaper El Comercio, reported. Enel Peru covers just over half of Lima's population, Reuters reported. In 2020, China's Three Georges Corporation acquired Luz del Sur, which provides energy to the other half of Lima. The National Society of Industries of Peru (SIN) expressed its concern over the sale and purchase agreement between CSGI and Enel Peru The Peruvian government should consider all the implications of allowing two foreign state-owned companies to control 100 percent of the electricity distribution service, in a key strategic sector for the country's economic development, SIN said in an April 11 statement. This is **not** about the creation of **a monopoly** in private hands but the creation of a monopoly in the **ownership** of electricity distribution in the hands of a **foreign power**, which could expose consumers to excessive prices as a consequence of the absence of competition, SIN warned. "China's **energy dominance** can generate widespread **discontent**, as seen in **Pakistan** and other countries **in Asia**," Fleischman said. "Chinese companies **displace** local **companies**, causing environmental and economic consequences. China's expansion is **at the expense** of local industry."

b. Willis '24 gives a litany more.

Willis 24 – Matthew Willis, 5-16-2024, New Security Beat, https://www.newsecuritybeat.org/2024/05/dont-panic-us-chinas-nuclear-power-ascendancy-has-its-limits/

Solar and wind power are scaling massively in China, with a recent projection estimating renewable installations will nearly triple current 2030 targets. Technological advancements have helped lower costs, making both sources easier to deploy than nuclear. The buildout of nuclear has paled in comparison. Grid and power market issues complicate the picture for wind and solar. "China is struggling to enhance its grid to accommodate more renewables, whose integration can significantly increase the needed provision of ancillary services for efficient power transmission and distribution," explained Cory Combs of Trivium China in an interview. This helps explain how nuclear can contribute to China's net-zero transition; off-grid reactors could power an industrial park or district heating without needing as much integration as renewables. However, nuclear will contend with improved grid integration and dispatching of renewable energy. China invests more in power transmission than the rest of the world combined. Energy storage capacity almost quadrupled in 2023. Entrenched fossil fuel interests remain, but Beijing has increasingly prioritized reforms to support renewables and establishing a unified national grid. As these grid upgrades and reforms progress, nuclear will see its comparative advantages diminish and remain a low contributor to the power mix. Inland Construction Barriers and Safety Shortfalls China imposed a moratorium on inland nuclear construction following the 2011 Fukushima accident, which impedes nuclear from hitting the 10% of power generation goal. While surveys show nuclear has public support, Chinese citizens have more negative views towards building reactors inland. "Considering current social and economic pressures, the Chinese government probably deems it too risky to lift the inland nuclear moratorium and agitate the public further," commented Philip Andrews-Speed of the Oxford Institute for Energy Studies in an interview. China's leaders are also wary of how inland construction could impact water resources. Current nuclear reactors consume billions of gallons of water annually. This makes them difficult to site in provinces like Sichuan and Yunnan, where waterways already fuel hydropower, supply thirsty industries, and are increasingly under threat due to climate-change induced droughts.

Non-water-dependent reactors are largely experimental and small-scale, leaving nuclear relegated to coastal areas and limited in scope. As more non-water-dependent reactors commercialize, inland construction could become more feasible, but competition with renewables and public opinion would still be challenges. Potential nuclear accidents pose another threat to inland plans. As of 2020, the National Nuclear Safety Administration (NNSA) had only 1,100 employees, only a third of the workforce employed by the US nuclear regulator. NNSA did not meet the State Council Research Office's recommendation of quadrupling its workforce by 2020. A strained workforce in a fast-growing sector increases risk of a serious accident which could damage public confidence and political support for nuclear. Boundaries of China's Nuclear Exports As renewable integration improves and nuclear faces various domestic obstacles, China's industry could seek to export more reactors abroad — mirroring strategies other countries employed during periods of domestic nuclear power stagnation. Nonetheless, nuclear projects have encountered hurdles in developing countries where substantial financial support, technical oversight, and design adaptations to local conditions are often required. Moreover, China has rarely mobilized its vast financial resources to support nuclear abroad. Even ignoring prospective stagnation at home and the unlikeliness of that leading to major exports, China's nuclear sector will be preoccupied with domestic commitments for some time. These constraints, paired with the Belt and Road Initiative's focus on other energy projects and the failure of past bilateral nuclear agreements, make it unlikely China will build 30 or more reactors overseas by 2030. Beijing will finance only so many projects abroad, especially with current high debt levels and other economic headwinds.

4. Russia exports of nuclear energy and materials declining now – Two warrants

a. Old plants closing, lack of natural resources, Ukraine

Bellona 24 – 3/13/2024 – "Rosatom's output dropped over the last year. We look at three reasons why" – Bellona, https://bellona.org/news/nuclear-issues/2024-03-rosatoms-output-dropped-over-the-last-year-we-look-at-three-reasons-why#:~:text=the%20last%20year.-,We%20look%20at%20three%20reasons%20why,icebreakers%2C%20and%20in%20foreign%20projects.

The output of **Russian nuclear power plants in 2023 decreased by 2.8%** compared to 2022. A decrease in output occurred for the first time in 10 years and only the second time in 20 years – the last one was in 2013. This seemingly purely internal event can actually tell a lot about the state of the Russian nuclear industrial giant and show several key points that are important both for Russia's neighboring countries and for the prospects of Rostom's foreign projects and its role in the global nuclear market in the next few years.

According to The Federal Service for State Statistics (Rosstat), nuclear power plant output in 2023 amounted to 217 billion kWh. This is 6.4 billion kWh less than the 2022 figure of 223.4 billion kWh, which became a record for the entire time of the Russian and Soviet nuclear industry. The output indicator of a nuclear power plant is extremely important for a state corporation that is proud of the fulfillment of important government tasks – both in state defense orders (nuclear weapons and their carriers), in the volume of transportation along the Northern Sea Route and the construction of nuclear icebreakers, and in foreign projects. In terms of electricity generation, Rosatom has also been given a task personally by Vladimir Putin – to achieve 25% of the share of nuclear energy in the country's energy balance by 2045, compared to about 18%-20% in recent years.

Therefore, the annual increase in electricity generation has always been an important indicator of which Rosatom was publicly proud. It is no coincidence that Rosatom has still not publicly announced the exact output figures for 2023, more than a month after the end of the year, since they show both a decrease in output from year to year and a decrease in the share of nuclear energy in the country's energy balance to 18.4% (it has been declining for the 4th year in a row). And in the coming years it will not be easy to even keep these indicators at their previous values.

The decline in output itself was expected for those who closely follow events in the Russian nuclear industry. And Rosatom itself, at the level of statements made by not top officials, recognized the upcoming difficulties. Commenting at the beginning of 2023 on the high output figures of 2022, First Deputy General Director for NPP operation, and since June 2023, General Director of Rosenergoatom concern (Electric Energy Division of Rosatom), Alexander Shutikov, said: "By optimizing repair campaigns and increasing the efficiency of electricity production, we were able to support until 2023 there is a constant increase in the level of production, but miracles do not happen. The output for the next three years will be lower. We know this and are ready for it."

The forecast indicators reflected what was said in words. For 2023, the state target for the production of Russian nuclear power plants, agreed with the federal antimonopoly service, was 214.2 billion kWh, which is almost 2% lower than a year earlier. This reduction allowed Rosatom to once again report on exceeding the state target, elegantly veiling the decline in output in absolute terms. At the same time, Rosenergoatom failed to achieve its own target of 218.8 billion kWh.

The main reason for this natural decline is the **aging of the country's nuclear fleet and the gradual closure of old power units,** to replace which there is n**o time to build new capacities**. In recent years, 4 large first-generation RBMK **uranium-graphite reactors** at the Leningrad and Kursk NPPs, which had **exhausted their service life** in 45 years, have been closed in Russia. The last one was just the other day, on January 31, 2024. But they were replaced by only two VVER-1200 units at Leningrad NPP-2. New units at Kursk NPP-2 lag behind the closure of old reactors by at least 3 years. This is precisely what accounts for the three-year period of expected decline. It is curious that the previous decline in nuclear power plant output in Russia in 2013 was also associated with first-generation RBMK reactors, which were taken out for repairs to carry out work to restore the parameters of the graphite stack.

5. Heg Transition is peaceful, china doesn't want to invade neighbors applies to c3.

Paul **Heer 19**. Served as National Intelligence Officer for East Asia in the Office of the Director of National Intelligence from 2007 to 2015, since served as Robert E. Wilhelm Research Fellow at the Massachusetts Institute of Technology's Center for International Studies and as Adjunct Professor at George Washington University's Elliott School of International Affairs. 1-8-2019. "Rethinking U.S. Primacy in East Asia." National Interest. https://nationalinterest.org/blog/skeptics/rethinking-us-primacy-east-asia-40972

But this policy mantra has two fundamental problems: it **mischaracterizes China's strategic intentions** in the region, and it is based on a U.S. strategic objective that is probably **no longer achievable**. First, China is pursuing **heg**emony in East Asia, but **not** an **exclusive hostile hegemony**. It is not trying to **extrude the U**nited **S**tates from the region or deny American access there. The Chinese have long recognized the **utility**—and the benefits to China itself—of U.S. engagement with the region, and they have indicated receptivity to **peaceful coexistence** and **overlapping spheres of influence** with the **U**nited **S**tates there. Moreover, China is **not trying to impose its political or economic system on** its **neighbors**, and it does not seek to **obstruct commercial f**reedom **o**f **n**avigation in the region (because no country is more dependent on freedom of the seas than China itself). In short, Beijing wants to extend its power and influence within East Asia, but **not as part of a "winner-take-all" contest**. China does have unsettled and vexing sovereignty claims over Taiwan, most of the islands and other features in the East and South China Seas, and their adjacent waters. Al**though** Beijing has demonstrated a **willing**ness to use force in defense or pursuit of these claims, it is **not looking for excuses** to do so. Whether these disputes can be managed or resolved in a way that is mutually acceptable to the relevant parties and consistent with U.S. interests in the region is an open, long-term question. But that possibility should not be ruled out on the basis of—or made more difficult by—**false assumptions of irreconcilable interests**. On the contrary, it should be pursued on the basis of a recognition that **all the parties want to avoid conflict**—and that the sovereignty disputes in the region ultimately are not military problems requiring military solutions. And since Washington has never been opposed in principle to reunification between China and Taiwan as long as it is peaceful, and similarly takes no position on the ultimate sovereignty of the other disputed features, their long-term disposition need not be the litmus test of either U.S. or Chinese hegemony in the region. Of course, China would prefer not to have forward-deployed U.S. military forces in the Western Pacific that could be used against it, but Beijing has **long tolerated** and arguably could **indefinitely tolerate** an American military presence in the region—unless that presence is clearly and exclusively **aimed at coercing** or containing **China**. It is also true that Beijing disagrees with American principles of military freedom of navigation in the region; and this constitutes a significant challenge in waters where China claims territorial jurisdiction in violation of the UN Commission on the Law of the Sea. But this should not be conflated with a Chinese desire or intention to exclusively "control" all the waters within the first island chain in the Western Pacific. The Chinese almost certainly recognize that exclusive control or "domination" of the neighborhood is not achievable at any reasonable cost, and that pursuing it would be counterproductive by inviting pushback and challenges that would negate the objective. So what would Chinese "hegemony" in East Asia mean or look like? Beijing probably thinks in terms of something much like American primacy in the Western Hemisphere: a model in which China is generally recognized and acknowledged as the de facto central or primary power in the region, but has little need or incentive for **militarily adventurism** because the mutual **benefits of economic interdependence prevail** and the neighbors have no reason—and inherent disincentives—to challenge China's vital interests or security. And as a parallel to China's economic and diplomatic engagement in Latin America, Beijing would neither exclude nor be hostile to continued U.S. engagement

in East Asia. A standard **counterargument** to this relatively benign scenario is that Beijing would **not be content** with it for long because China's strategic ambitions will expand as its capabilities grow. This is a valid **hypothesis**, but it usually overlooks the greater possibility that China's external ambitions will expand **not because** its **inherent capabilities have grown**, but because Beijing sees the need to be more assertive in **response to external challenges to Chinese** interests or **security**. Indeed, much of China's "assertiveness" within East Asia over the **past decade**—when Beijing probably would prefer to focus on domestic priorities—has been a **reaction to** such **perceived challenges**. Accordingly, Beijing's willingness to settle for a narrowly-defined, peaceable version of regional preemin

A2 AI

1. U.S. is locked in to win, VIctor from April

Ebo Victor, 4-8-2025, "Meta's Llama 4 Models Spark U.S. AI Comeback, Says David", archive.ph, https://archive.ph/VhEwR//EEdoa04/13/25

Meta's Llama **4 AI models aim to put the U.S. back on top** in the AI race, according to advisor David Sacks. Llama 4 Scout and Maverick **outperform global competitors** using a unique Mixture of Experts design and multimodal capabilities. **Open-source innovation is now America's counter** to rising Chinese AI power, with Meta's AI models integrated into WhatsApp and Instagram. Meta's newest Open Source AI models, Llama 4 Scout and Llama 4 Maverick, have created a buzz in the tech industry. David Sacks—a US venture capitalist and AI advisor—expressed his excitement regarding these models over the weekend on X, describing the products as a '**victory for America' in the global AI competition.** "For the U.S. to win the AI race, we have to win in open source too, and Llama 4 puts us back in the lead," he wrote.

2. AI energy intensity rapidly decreasing and companies solve now.

Ramachandran '24[Vijaya; Director for Energy & Development @ the Breakthrough Institute, Board Member of the Energy for Growth Hub, PhD in Business Economics from Harvard University; July 9; Breakthrough Institute; "Unmasking the Fear of AI's Energy Demand," https://thebreakthrough.org/journal/no-20-spring-2024/unmasking-the-fear-of-ais-energy-demand; DOA: 3-24-2025] tristan

In a detailed thread on X, MIT Innovation Fellow and former National Economic Council director Brian Deese argues that forecasters consistently overestimate electricity demand, in part because they emphasize static load growth over efficiency gains. Deese points out that in the early 2000s, analysts predicted surging electricity demand. Instead, U.S. electricity demand has stayed flatfor two decades. And although data center energy use is increasing, energy intensity (energy use per computation) has decreased by 20% every year since 2010. Nvidia—one of the largest companies designing graphics processing units (GPUs) for gaming, professional visualization, data centers, and automotive markets—is continuously improving the energy efficiency of its GPUs. Its new AI-training chip, Blackwell, for example, will use 25 times less energy than its predecessor, Hopper. Deese points out that analysts may be double-counting energy use by data centers because technology companies initiate multiple queries in different utility jurisdictions to get the best rates.

A (carbon-heavy) query to ChatGPT suggests AI and data service providers have considerable room to improve the energy efficiency of data center infrastructure using various measures:

Virtualization and Consolidation: Virtualization technology can be used to consolidate servers and reduce the number of physical machines running. This can lead to significant energy savings by optimizing server utilization rates.

Efficient Cooling Systems: Cooling accounts for a substantial portion of a data center's energy consumption. Implementing efficient cooling techniques such as hot/cold aisle containment, using free cooling when ambient temperatures allow, and employing modern cooling technologies like liquid cooling can reduce energy usage.

Energy-Efficient Hardware: Energy-efficient servers, storage devices, and networking equipment can be a priority, as can the use of products with high energy efficiency ratings (such as ENERGY STAR certified devices), with use configurations optimized for lower power consumption.

Power Management Software: Power management tools and software can monitor and adjust power usage based on demand. This includes dynamically adjusting server power levels during periods of low activity (e.g., using power capping techniques).

Optimized Data Center Layout: Data center layouts can be designed to minimize energy waste and optimize airflow. This includes proper rack layout, efficient cable management, and ensuring equipment is placed to minimize cooling requirements.
Energy-Efficient Data Storage: Efficient data storage technologies and practices, such as data de-duplication and compression, can be used to reduce the overall storage footprint and associated energy requirements. Continuous monitoring and optimization will also help.

Electricity demand from electric vehicles (EVs) may prove to be comparable or even higher than that of AI. The Princeton REPEAT model estimates the demand for electricity in the United States at 391 TWh for EV transportation (light-duty vehicles and other electric transport) in 2030, which is similar to BCG's 2030 estimates for data centers (320 - 390 TWh). Rystad Energy predicts EV usage will grow from 18.3 TWh to 131 TWh for the same period. Despite the additional energy demand, policymakers strongly encourage the purchase of EVs and the construction of charging infrastructure, while commentators seem relatively unconcerned about EV charging needs. This may be because EVs are seen to be filling an existing societal need for transportation, as well as a solution to the problem of climate change. Even though AI has potential to raise productivity and improve lives, it is a new and energy-intensive technology whose value runs counter to the priorities of the environmental community.

No matter the level of future AI use, AI's energy demand will make it more difficult—if not impossible—to dismiss the intermittency challenges associated with powering commercial and industrial loads with wind and solar energy. Data centers' real-time power demand requires continuous, dispatchable power which cannot be provided solely by renewables without significant excess generation capacity and large amounts of cheap storage.

Technology companies like Microsoft and Google are taking steps to meet their data center energy needs. Microsoft recently inked an agreement with Constellation Energy to supply its data center with nuclear-produced power. Other firm clean energy sources may also play crucial roles in decarbonizing AI energy consumption. Last year, Google partnered with Fervo Energy to powerits Nevada-based data center with geothermal power. At least one hydropower developer—Rye Development—is planning to develop hydroelectric facilities to match data center electricity use.

The bottom line is that we do not need to fear AI's challenge to the energy grid. Utilities and tech companies will meet increased demand by using a mix of energy sources, including clean and firm electricity supplies like nuclear energy, geothermal power, and even hydropower. AI is not the first—and nor will it be the last—game changer in society's energy consumption. The discourse on AI's energy footprint must therefore shift from apprehension to proactive problem-solving,focused on energy efficiency gains and diversification of clean energy sources, driven by the notion that a high-energy planet is essential for human progress.

3. Nuclear energy fails to meet AI demand--- delays, costs, unreliability, and weather.

CAN 24 [No Author, Europe's leading NGO coalition fighting climate change with over 200 member organizations, 3-19-2024, Myth buster: Nuclear energy is a dangerous distraction, Climate Action Network Europe, https://caneurope.org/myth-buster-nuclear-energy/] BZ

Fact #2: New nuclear construction is too slow

Myth #2: New nuclear is an effective solution to align Europe to the Paris Agreement and keep global temperature increase to 1.5°C
A rapid transition requires the use of existing technologies and solutions which can most quickly be rolled-out such as renewables, primarily solar and wind, energy efficiency, and system flexibility. For years, new nuclear energy projectsin Europe have been plagued with delays and, coupled with an untrained workforce, are unable to support the speed of

decarbonisation necessary. New nuclear plants typically take 15-20 years for construction, hence failing to address immediate decarbonisation needs to 2030. Indicatively, France's six new reactors are estimated by its network operator to enter into use in 2040-2049, much too late to have any meaningful impact on emissions reduction needed already now, with a view to pathways to 2040, and beyond, for a sustainable future.

The decision to build the UK's Hinkley Point C nuclear reactor was announced in 2007 with an operational start date of 2017, however it has been delayed several times over, and is now estimated to start in 2031. In France, the Flamanville project is 16 years into construction and hitting new delays, while Finland's Olkiluoto took a full 18 years to come online.

Nuclear power is too expensive

When compared to renewables, the latest analysis from World Nuclear Industry Status Report, using the data from Lazard, determines that the levelized cost of energy (LCOE) for new nuclear plants makes it the most expensive generator, estimated to be nearly four times more expensive than onshore wind, while unsubsidized solar and wind combined with energy storage (to ensure grid balancing) is always cheaper than new nuclear.

Recent European projects in Slovakia, the UK, France, and Finland demonstrate the dramatic rising costs. EDF admitted that the costs for the British nuclear facility Hinkley Point C will skyrocket to 53.8 billion euros for the scheduled 3.2 GW power plant, more than twice as much as scheduled in 2015 when the plant was approved. The French project in Flamanville was originally projected to cost 3.3 billion euros when it began construction in 2007, but has since risen to 13.2 billion euros(16.87 billion euros in today's money). The Finnish Olkiluoto-3 project 1.6GW reactor cost 3 times more than the original forecast price, reaching 11 billion euros. Slovakia's second generation reactors Mochovce 3 and 4 ballooned costs to 6.4 billion euros from an initially estimated 2.8 billion. Slovenia's president announced that a new 1.6GW reactor would cost 11 billion euros, following the Finnish example, demonstrating that these high prices are here to stay.

Renewables and energy efficiency are cheaper alternatives

When compared against energy savings, analysis by Hungarian NGO Clean Air Action Group highlights that it is more economically efficient to invest in the renovation of households to save energy than in the construction, operation, and decommissioning of a new nuclear reactor. These findings were confirmed by a separate study by Greenpeace France, that showed that by investing 52 billion euros in a mix of onshore wind infrastructure/photovoltaic panels on large roofs, it would be possible to avoid four times more CO_2 emissions than by investing the same amount in the construction of six EPR2 nuclear reactors by 2050, while electricity production triples. By investing 85 billion euros of government subsidies in energy savings by 2033, it would be possible to avoid six times more cumulative CO_2 emissions by 2050 than with the construction program of six EPR 2 reactors. This would also make it possible to lift almost 12 million people out of energy poverty in a decade.

In order to finance new and ongoing projects, the EU has approved State Aid for nuclear, in the case of Hungary, Belgium, and the United Kingdom, while national governments seek support schemes. Despite making references to technology-neutrality, this creates an unlevel playing field slanted against renewable energy. Given the significant investment gap to achieve 2030 climate targets, and the limited fiscal space of many Member States, investments in nuclear risk diverting precious public resources into projects of poor value-for-money compared to alternatives in a renewables-based system, while reducing the availability of public resources for all other components of the energy transition. Such
a choice would equally fail to reduce prices for consumers in the context of the current fossil fuel

energy crisis. Nuclear power includes many additional hidden costs The costs would be even larger if accounting for "unpaid externalities" borne by taxpayers and the public at large, from nuclear accident risks that are impossible to insure against by private actors. The costs of decommissioning of a nuclear power plant, which can cost 1-1.5 billion euros per 1000 MW, are often borne by the public as these costs are poorly taken into account when planning a new nuclear installation. The cost associated with storing radioactive waste for hundreds of thousands of years is also often undervalued, alongside costs associated with radioactive leaks from plants or storage facilities, as demonstrated by the radioactive leaks in the UK Sellafield site, causing tension with Ireland and Norway. To lower costs, attempted lowering of safety and environmental standards can be expected, posing risks to communities, nature, and society at large, also as a burden to future generations.

Myth #3: New innovation will solve the issues of cost and inflexibility

Fact #3: Small Modular Reactors are not coming to save us

Argued to be more flexible, decentralised, smaller, and cheaper than existing nuclear designs, countries are wasting public resources in favour of non-existent Small Modular Reactor (SMRs), riddled with the same limitations as their predecessors, and presenting poor value-for-money compared to existing alternatives. The focus on SMRs risks delaying the development of renewable energy technologies already available at the moment, and thereby prolonging the usage of fossil fuels., ,

Burdened by the same high capital costs, SMRs would have to run near constantly to reduce losses, thereby further congesting the grid and making them useless in providing back-up power needed for peak hours against renewables and energy storage.

Small Modular Reactors are untested

Only few SMRs in China and Russia are currently in operation. Since the technology has not been tested yet at commercial scale, claims that the industry is making about their supposedly faster construction and lower costs are therefore purely speculative at this stage. An SMR project that was planned in the US state of Utah, was terminated in November 2023 as local authorities that were meant to buy the electricity pulled out due to rising costs. The same company that failed with this project intends to build SMRs in Romania, Kazakhstan, Poland and Ukraine.

Fact #4: Studies demonstrate that 100% renewable by 2040 is feasible and favourable

Myth #4: A 100% renewable energy system is unfeasible, and renewables must work together with nuclear

The Paris Agreement Compatible (PAC) scenario, developed by civil society and experts, emphasises renewables-based electrification and energy demand reduction, calling for determined and heightened attention to enable a 100% renewables-based EU energy system by 2040, and foresees no need for nuclear power in Europe. A fully renewables-based energy system even functions in times of low wind and at night, when the sun is not shining. The solution to still provide the required amount of power needed during these times is a combination of flexibility (such as energy storage) and demand-side measures. The myth of the need for nuclear baseload has been debunked for years. The energy system can be reliably and safely managed with 100% renewables and system flexibility.

Nuclear power production is not reliable: Nuclear power units across Europe have been proven as unreliable in providing power when needed. Future climatic conditions, such as heatwaves, droughts, flooding and rising sea-levels only increase the likelihood of future nuclear power plant disconnections and pose further security risks. In 2022, on average French nuclear reactors had 152 days with zero-production. Over half of the French nuclear reactor fleet was not available during at least one-third
of the year, one-third was not available for more than half of the year, and 98% of the year 10 reactors

or more did not provide any power for at least part of the day.

4. Hydroelectricity solves, Seal from April

Thomas Seal, 4-11-2025, "Canada Has Answer to Energy Needs in AI Race, Ex-Google CEO Says", archive.ph, https://archive.ph/0I6G4//EEdoa04/13/25

Canada's abundant hydroelectricity offers the best way to power booming artificial intelligence servers and win the global AI race — if the country is able to cooperate with the US amid a trade war with President Donald Trump, according to former Google chief Eric Schmidt. "Th**ere's a real limit in energy,**" Schmidt told the TED conference in Vancouver on Friday, citing an estimate that the US industry will need 90 additional gigawatts to not throttle data centers. "My answer, by the way, is: Think Canada. Nice people, full of hydroelectric power. But that's apparently not the political mood right now — sorry," he said, in a reference to Trump's tariffs and claims that Canada has "nothing" the US needs. He said a typical nu**clear power plant produces about 1 gigawatt, and the construction of 90 plants in America isn't happening. "**How are we going to get all that power? This is a major major national issue." Politicians in Canada are aware of the tech giants' demand for power and some have talked about serving it. "We have about 250 data centers in Canada — we could do a hell of a lot more, and our secret sauce is our energy, our incredible supply of energy of all kinds: **hydro**, nuclear, natural gas, you name it," Conservative leader Pierre Poilievre said in a January interview. "So let's **unleash the production** of these resources and bring all that money home."

5.NU: Alt causes like transmission lines can't handle the load

Mathias **Einberger** [former manager in RMI's Carbon-Free Electricity Program, where he was a part of the Clean Competitive Grids Initiative. He focused on modernizing and expanding the power grid to enable economy-wide decarbonization through carbon-free electricity. In addition to the power system's physical infrastructure, Mathias also worked on updating its institutional infrastructure to remove regulatory and market barriers to a carbon-free future], 20**23**-01-12, "Reality Check: The United States Has the Only Major Power Grid without a Plan," RMI, https://rmi.org/the-united-states-has-the-only-major-power-grid-without-a-plan/, Date Accessed: 2025-04-02T00:50:27.864Z //RX

The Myth

The US electric grid is often referred to as the greatest machine in the world. It is indeed an engineering marvel: a network of several hundred thousand miles of power lines connect thousands of electric generators to power households and businesses across the contiguous United States. But in the aftermath of winter storm Elliott and the rolling power outages its frigid cold inflicted on many Americans, we need to ask ourselves: is this machine a match for these types of extreme weather events blanketing the country with ever increasing frequency and ferocity?

The Reality

The US power grid is, in fact, highly fragmented and consists of not one, but three different sections. These are called the Eastern, Western, and ERCOT interconnections — three separate power grids that are almost completely isolated from one another, electrically

speaking. To make matters worse, the **high-voltage, long-distance** electric **transmission lines** that form the backbone of each of these grids **are** largely **planned in even greater local isolation.**

Today, there are 12 different transmission planning regions, all of which except for the Electric Reliability Council of Texas (ERCOT) are under the jurisdiction of the Federal Energy Regulatory Commission (FERC). Yet, only six of them are full Regional Transmission Organizations (RTOs) — sometimes referred to as Independent System Operators, a nuanced distinction and yet another acronym that we shall spare the readers from — with the mandate and authority to conduct transmission planning for their region. The remaining five planning regions in the West and Southeast are much more loose associations of dozens of vertically integrated utilities, which tend to plan transmission mostly with just their own local territories (or balancing authorities) in mind.

Illustration of major planning boundaries within the US power grid

Source: RMI illustration of RTO and **no**n-RTO regions (including ERCOT), approximated based on FERC Order 1000 transmission planning regions, balancing authorities are based on HIFLD. The map was created in QGIS.

As Aaron Bloom, Executive Director of NextEra Energy Transmission, LLC put it at a recent FERC workshop on the matter, "The United States is the only macro grid in the world that doesn't have a plan of any type." Indeed, both the European Union and China have continental-/**national-scale grid development plan**s. The United States does not.

The Problem with Fragmented Planning

This type of fragmented planning framework is highly problematic, because the **power grid is under growing stress** from climate change-related extreme weather. High-stress events like winter Storm Elliot — the extreme cold snap that blitzed much of the nation at the end of last year — or Winter storm Uri in 2021, which led to over 210 deaths, caused almost 70 percent of Texans to lose power and 50 percent to lose water, and cost at least $80 billion, are becoming increasingly frequent. The associated weather patterns are much larger than our current fragmented grids and grid planning regions, which therefore **struggle with the** coordinated **response needed to future-proof our vital power supply system.**

6. Even if construction gets sped up, licensing still takes forever, even with SMR's Vondracek '20

Sarah H. Vondracek (Manager at ScottMadden focusing on electric utility grid modernization through strategic planning, rate case management, and program development. Joined ScottMadden in 2020 after receiving an M.B.A. from the University of North Carolina's Kenan-Flagler Business School and a Master of Environmental Management from Duke University's Nicholas School of the Environment. Also holds a B.A. in Biology and Environmental Studies from Colgate University), 04-24-2020, "Impacts of the Changing Regulatory Landscape on New Nuclear in the United States," No Publication, https://www.kenan-flagler.unc.edu/wp-content/uploads/2022/07/Impacts-of-the-Changing-Regulatory-Landscape-on-the-New-Nuclear-in-the-US.pdf, accessed 4-12-2025 //RP

New Nuclear Construction Time Before the latest round of controversial nuclear builds in the 2000s, the newest rectors to enter into services were Tennessee's Watts Bar Unit 2 (June 2016) and Watts Bar Unit 1 (May 1996) (EIA, 2019). During the construction of Units 1 and 2 in 1985, TVA suspended construction of Watts Bar Unit 2 (U.S. NRC, 2016). Then during the time of increased interest in nuclear energy as previously discussed, TVA informed the NRC in 2007 of its plan to restart the construction of Watts Bar Unit 2 (U.S. NRC, 2016). The Tennessee Watts Bar Unit 2 operating permit was issued on October 22, 2015. Therefore, **from re-initiation of construction to the issue of the operating permit took approximately 10 years.** Regulatory Change Impact on United States New Nuclear 16

Vogtle is currently the only project that is still under construction in the U.S. Unit 3 and 4 had the COL permit issued on February 10, 2012 and have yet to be approved for operations. Work began in 2009 to prepare the site, and after receiving their COL they began construction in 2013 (Staff reports, The Atlanta Journal-Constitution, 2017). The construction was supposed to be completed by 2016 for ($14 B) for Unit 3 and 2017 for Unit 4, but they are still under construction (EIA, 2019). In a recent update from Georgia Power, the project successfully completed all milestones in the first three months of 2019 (Georgia Power, 2019). This indicates an improvement in project management as they have previously missed key construction milestones. Based on the company's current analysis, the Vogtle project is now on track for the updated project deadline approved by the Georgia Public Service Commission (PSC). The new goal dates are November 2021 for Unit 3 and November 2022 for Unit 4 (Georgia Power, 2019)**. So far, their project planning and construction process has lasted over 10 year**