We Negate, “Resolved: The United States federal government should substantially increase its investment in domestic nuclear energy.”

Contention 1: Meltdowns

CURRENTLY, the NRC does just enough to maintain nuclear safety of the decreasing number of nuclear power plants in the US.

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[d] in enforcement findings and indicated that it will focus[es] 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:

BUT, Affirming would increase the risk of meltdowns in 3 unique ways.

FIRST is New Tech Stresses Resources

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.nuclearinn2ovationalliance.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.**

SECOND is the new Energy Secretary.

Accountable 25 [Accountable US (Accountable.US (A.US) is a nonpartisan, 501(c)3 organization that shines a light on special interests that too often wield unchecked power and influence in Washington and beyond.) February 4, 2025, Watchdog: Senate Confirms Oil Man & Serial Workplace Safety Violator Chris Wright as Trump's Energy Secretary", https://accountable.us/watchdog-senate-confirms-oil-man-serial-workplace-safety-violator-chris-wright-as-trumps-energy-secretary/, GZR]

WASHINGTON, D.C. – Following the Republican-led Senate's vote to confirm Chris Wright as **U.S. Energy Secretary**, Accountable.US Executive Director Tony Carrk released the following statement: "The choice of Chris Wright to run the powerful Energy Department was based on what's best for the bottom line of Donald Trump's big oil megadonors, not everyday consumers and workers. With his Project 2025 ties and financial stakes in the big oil and nuclear industry, Wright is just the wealthy insider Trump needs to carry out his plans for padding profits of energy special interests – even if it means higher prices at the pump. And with Wright's company's history of violating workplace safety standards and anti-discrimination laws, he's now in the driver's seat to sweep such problems under the rug for his industry friends." BACKGROUND: Conflicts Of Interest With Energy Companies **Chris Wright is a member of the board of Oklo nuclear company and has business before the Department of Energy. Oklo's application before the Nuclear Regulatory Commission was previously denied due to a lack of information about accidents and safety. Chris Wright claims he will step down from the board, but questions remain about whether he will fairly regulate and ensure accountability from energy industries** when he has spent so much of his career working for and serving on the boards of oil and gas and nuclear energy companies. Project 2025 Wright has been on the board of the Western Energy Alliance, an oil industry trade group that authored many of Project 2025's oil and gas provisions. Chris Wright has been a member of the board of Western Energy Alliance (WEA) WEA is an oil industry trade group. WEA's president authored the oil and gas provisions of Project 2025. Project 2025 would eliminate "key offices at the DOE, including the Office of Energy Efficiency and Renewable Energy, the Office of Clean Energy Demonstrations, the Office of State and Community Energy Programs, the Office of Grid Deployment, and the Loan Programs Office." Workplace Safety and Racial Harassment **Questions remain whether Wright will**

look the other way when energy companies violate safety standards and anti-discrimination laws, considering his company, Liberty Energy, was frequently fined over workplace safety standards and paid $265,000 to settle lawsuits from black and Hispanic employees who faced hostile work environment and were called slurs. **Under Chris Wright's leadership, Liberty Energy has faced at least three separate penalties for workplace and safety violations** since 2023. Liberty Energy, in 2024, paid $265,000 to settle an EEOC discrimination lawsuit after black and Hispanic field mechanics faced racial harassment.

THIRD is lack of independent regulators

Huff et al. 3-6 [Katy Huff, Paul Wilson, Michael Corradini, 3-6-2025, [Katy Huff is a former Department of Energy assistant secretary for nuclear energy and is currently an associate professor at the University of Illinois in Urbana-Champaign; Paul Wilson is the Grainger Professor of Nuclear Engineering and the chair of the University of Wisconsin–Madison's department of nuclear engineering and engineering physics; Michael Corradini a former member of the U.S. Advisory Committee on Reactor Safeguards, a former president of the American Nuclear Society and a professor emeritus at the University of Wisconsin–Madison. "Killing a Nuclear Watchdog's Independence Threatens Disaster," Scientific American, https://www.scientificamerican.com/article/killing-a-nuclear-watchdogs-independence-threatens-disaster/] //cy

A Trump administration executive order is setting the U.S. on the **fastest path to a nuclear accident**. Announced on February 18, the "Ensuring Accountability for All Agencies" executive order aims to bring[s] independent regulatory agencies under the "supervision and **control" of the president**. Among them, the Nuclear Regulatory Commission is the watchdog that Americans rely on to hold nuclear energy companies accountable for avoiding reactor accidents and releases of radioactive material into the environment. By demanding that the NRC cease to issue regulations and guidance without written permission from the president or the attorney general, the order effectively demands that nuclear safety take a back seat to politics. As nuclear engineers, as well as former government and industry officials, we foresee that this proposed regulatory capture by the Executive Office of the President—where decisions are made for political reasons and not for the benefit of people served—**will severely increase the risk of expensive, unexpected nuclear accidents** in the U.S. This is neither hypothetical nor hyperbole. History provides **too much frightening evidence** to ignore. When Soviet leadership and its captured regulator prioritized national pride over safety, a known flaw in nuclear reactor control rods (which slow the rate of atomic fission in a reactor) went unchecked, safety protocols at the Chernobyl Nuclear Power Plant went unheeded, and in 1986 the **worst nuclear power accident in history** resulted. So too when "regulation was entrusted to the same government **bureaucracy responsible for its promotion**," the operators of Japan's Fukushima Daiichi Nuclear Power Plant **failed to deploy countermeasures** demanded by known seismic risks; they failed to plan appropriately for evacuation; and in 2011, they failed to avoid the second worst nuclear power accident in human history. In 1974 Congress recognized the importance of independent nuclear oversight, reorganizing the Atomic Energy Commission into two distinct agencies: the Department of Energy, responsible for research, development and promotion of nuclear energy; and the NRC, to regulate and oversee the then-booming nuclear energy industry. Five NRC commissioners, each appointed by the president and confirmed by the Senate, work together to "formulate policies and regulations governing nuclear reactor and materials safety, issue orders to licensees, and adjudicate legal matters brought before [them]." The president has the authority to designate one of these commissioners as the chair, acting as the chief executive officer of the agency. **International** consensus is clear about what works and what doesn't in nuclear safety regulation. Most fundamentally, the regulator's ability to ensure safe nuclear power operation requires independence, especially from entities with a conflict of interest. The International Atomic Energy Agency, humanity's foremost authority on nuclear energy safety and security, is clear that governments must ensure that the regulatory body is not influenced by "entities having responsibilities or interests that could unduly influence its decision making." Failure to maintain regulatory independence from commercial, political and ideological influence is not accountability. It is instead regulatory capture. Both President Trump and Secretary of Energy Chris Wright, by virtue of their offices, have responsibilities and interests that demand efforts to expand nuclear power. The country's continued prosperity relies heavily on secure access to reliable energy, and nuclear energy has a unique role in meeting our energy demands. Nuclear energy is one of the nine pillars of Wright's secretarial order calling for action to "unleash American Energy." In a recent CNBC interview, when describing his optimism for growth in nuclear energy, Wright recently declared, "Do we need some government out of the way to make it work economically? Absolutely, but that's what America is about." That's true only if industrial accidents are also what America is about. In reality an independent regulator plays a **fundamental role** in generating public confidence in the safe and secure deployment of nuclear technology. While discussions about the effectiveness of the agency are appropriate, such discussions never question the importance of its continued independence. Even for officials in the Office of Nuclear Energy at DOE, the independence of the NRC is a red line no one would ever consider crossing, precisely because DOE's role involves the enthusiastic promotion of nuclear energy. Nuclear energy relies on precision technology and an unwavering dedication to safety, so regulating it is a serious technical undertaking meant to shield us from unwanted radiological consequences. The U.S. has historically been a **global leader** in nuclear regulatory practices and principles that **uphold the highest standards of safety globally**. A critical component of their operation is independence from conflicting motives. Nuclear safety is too important to undermine through uninformed political actions. Regulatory capture by industry, politics or the whims of an individual is not merely dangerous—it is the primary cause of the two worst nuclear reactor accidents the world has known. We cannot allow this to occur in the U.S. The NRC must remain independent to provide the public confidence in the safe implementation of this important technology.

AND, this lack of independent regulation uniquely makes new technologies more susceptible to meltdowns.

Macfarlane 2-21 [Allison Macfarlane, 2-21-2025, professor and director of the School of Public Policy and Global Affairs @ the University of British Columbia, chaired US Nuclear Regulatory Commission from 2012-2014, doctorate in geology from MIT, served on the White House Blue Ribbon Commission on America's Nuclear Future "Trump just assaulted the independence of the nuclear regulator. What could go wrong?," Bulletin of the Atomic Scientists, https://thebulletin.org/2025/02/trump-just-assaulted-the-independence-of-the-nuclear-regulator-what-could-go-wrong/] //cy

What could go wrong? Several possible outcomes could occur because of Trump's new executive order assaulting the independence of the Nuclear Regulatory Commission (NRC). Proponents of small modular reactors, for instance, have pressured **Congress and the executive branch** to **reduce regulation** and hurry the NRC's approval of their novel—and **unproven**—reactor designs. They wish their reactors could be exempted from the requirements that all other designs before them have had to meet: detailed evidence that the reactors will operate safely under accident conditions. Instead, these proponents—some with **no experience in operating reactors**—want the NRC to trust their **simplistic computer models** of reactor performance and essentially give them a free pass to deploy their **untested technology** across the country. An accident with a new small modular reactor (SMR) would perhaps not make such a big mess: After all, the source term of radiation would be smaller than with large reactors, like those currently operating in the United States. But the **accident in Japan** demonstrated that countries should expect that **more than one** reactor at a given site can fail at the same time, and these multiple failures can create even more **dire circumstances,** impeding the authorities' ability to respond to such a **complex radiological emergency**. At Fukushima, the first explosion at Unit 1 generated radioactive debris that prevented emergency responders from getting close to other damaged reactors nearby. Since designers plan to deploy multiple SMR units to individual sites, such an accidental scenario appears feasible with SMRs. Since its creation in 1975, the Nuclear Regulatory Commission has had an excellent and essential mission: to ensure the safety and security of nuclear facilities and nuclear materials so that humans and the environment are not harmed. Trump's incursion means the [NRC] agency will no longer be able to fully follow through with this mission **independently**—and Americans will be more at risk as a result. [o]If any US reactor suffers a major accident, the **entire industry will be impacted**—and perhaps its **94 reactors in operation** will even be temporarily **shut down**. Can the industry and the American people afford the cost of losing the independence of the nuclear regulator?

AND, without careful regulations, the increase in nuclear energy could lead to total human extinction.

Slocum 15 [Christopher Allen Slocum 15, VP @ AO&G, "A Theory for Human Extinction: Mass Coronal Ejection and Hemispherical Nuclear Meltdown," 07/21/15, The Hidden Costs of Alternative Energy Series, http://azoilgas.com/wp-content/uploads/2018/03/Theory-for-Human-Extinction-Slocum-20151003.pdf]

With our intelligence we have littered the planet with massive spent nuclear fuel pools, emitting **lethal radiation** in over-crowded conditions, with circulation requirements of **electricity**, **water**-supply, and neutron **absorbent chemicals**. The failure of **any** of these conditions for any calculable or incalculable reason, will release all of a pool's **cesium** in**to** the **atmosphere**, causing 188 square miles to be contaminated, 28,000 cancer deaths and $59 billion in damage. As of 2003, 49,000 tons of SNF was stored at 131 sites with an additional 2,000-2,400 metric tons produced annually. The NRC has issued permits, and the nuclear industry has amassed unfathomable waste on the premise that a deep geological storage facility would be available to remediate the waste. The current chances for a deep geological storage facility look grim. The NAS has required geologic stability for 1,000,000 years. It is impossible to calculate any certainty 1,000,000 years into the future. Humanity could not even predict the mechanical failures at Three Mile Island or Chernobyl, nor could it predict the size of the tsunami that triggered three **criticality** events at Fukushima Daiichi. These irremediable crises span just over 70 years of human history. How can the continued production and maintenance of SNF in pools be anything but a **precedent** to an **unprecedented human cataclysm**? The Department of Energy's outreach website explains nuclear fission for power production, providing a timeline of the industry. The timeline ends, as does most of the world's reactor construction projects in the 1990s, with the removal of the FCMs from Three Mile Island. One would think the timeline would press into the current decade, however the timeline terminates with the question, "How can we minimize the risk? What do we do with the waste?" (The History of Nuclear Energy 12). Nearly fifteen years into the future, these questions are no closer to an answer. The reactors at Fukushima Daiichi are still emitting radioisotopes into the atmosphere, and their condition is unstable. TEPCO has estimated it could take forty years to recover all of the fuel material, and there are doubts as to whether the decontamination effort can withstand that much time (Schneider 72). A detailed analysis of Chernobyl has demonstrated that nuclear fall-out, whether from thermonuclear explosions, spent fuel pool fires, or reactor core criticality events are deleterious to the **food-chain**. **Cesium** and strontium are taken into the **roots** of **plants** and **food** crops, causing direct **human** and **animal** contamination from ingestion, causing cancer, teratogenicity, mutagenesis and death. Vegetation suffers mutagenesis, reproductive loss, and death. Radioactive fields and **forest** floor**s** **decimate invertebrate** and **rodent variability** and number necessary to supply nature's **food-chain** and **life** **cycles**. The **flesh and bones** of freshwater and oceanic biota contribute significantly to the total radiation dose in the food-chain. Fresh **water** **lakes**, **rivers** and **streams** become radioactive. Potable **aquafers** directly underlying SNFs and FCMs are penetrated by downward migration of radioisotopes. **Humans must eat to live. Humans must have water. No human can survive 5 Sv of exposure** to ionizing radiation, many cannot survive exposure to 1 Sv.

Contention 2: Renewables Trade-Off

Clean energy is rapidly advancing and solves energy needs by 2035.

Beinhocker 25 [Eric Beinhocker, 2-28-2025, "The Clean Energy Revolution Is Unstoppable", [Eric Beinhocker is a Professor of Public Policy Practice at the Blavatnik School of Government, University of Oxford. He is also the founder and Executive Director of the Institute for New Economic Thinking at the University's Oxford Martin School. INET Oxford is an interdisciplinary research center dedicated to the goals of creating a more inclusive, just, sustainable, and prosperous economy. Beinhocker is also a Supernumerary Fellow in Economics at Oriel College and an External Professor at the Santa Fe Institute.], https://www.wsj.com/business/energy-oil/thecleanenergyrevolution-is-unstoppable-88af7ed5,] //Wenzhuo recut //cy

Since Donald Trump's election, clean energy stocks have plummeted, major banks have pulled out of a U.N.-sponsored "net zero" climate alliance, and BP announced it is spinning off its offshore wind business to refocus on oil and gas. Markets and companies seem to be betting that Trump's promises to stop or reverse the clean energy transition and "drill, baby, drill" will be successful. But this bet is wrong. The clean energy **revolution** is being driven by fundamental technological and economic forces that are too strong to stop. Trump's policies can **marginally slow progress** in the U.S. and harm the competitiveness of American companies, but they cannot halt the fundamental dynamics of technological change or save a fossil fuel industry **that will** inevitably **shrink** dramatically in the next two decades. Our research shows that once new technologies become established their patterns in terms of cost are surprisingly predictable. They generally follow one of three patterns. The first is a pattern where costs are volatile over days, months and years but relatively flat over longer time frames. It applies to resources extracted from the earth, like minerals and fossil fuels. The price of oil, for instance, fluctuates in response to economic and political events such as recessions, OPEC actions or Russia's invasion of Ukraine. But coal, oil and natural gas cost roughly the same today as they did a century ago, adjusted for inflation. One reason is that even though the technology for extracting fossil fuels improves over time, the resources get harder and harder to extract as the quality of deposits declines. here is a second group of technologies whose costs are also largely flat over time. For example, hydropower, whose technology can't be mass produced because each dam is different, now costs about the same as it did 50 years ago. Nuclear power costs have also been relatively flat globally since its first commercial use in 1956, although in the U.S. nuclear costs have increased by about a factor of three. The reasons for U.S. cost increases include a lack of standardized designs, growing construction costs, increased regulatory burdens, supply-chain constraints and worker shortages. A third group of technologies experience predictable long-term declines in cost and increases in performance. Computer processors are the classic example. In 1965, Gordon Moore, then the head of Intel, noticed that the density of electrical components in integrated circuits was growing at a rate of about 40% a year. He predicted this trend would continue, and Moore's Law has held true for 60 years, enabling companies and investors to accurately forecast the cost and speed of computers many decades ahead. Clean energy technologies such as **solar, wind and batteries** all follow this pattern but at different rates. Since 1990, the cost of wind power has dropped by about 4% a year, solar energy by 12% a year and lithium-ion batteries by about 12% a year. Like semiconductors, each of these technologies can be mass produced. They also benefit from advances and economies of scale in related sectors: solar photovoltaic systems from semiconductor manufacturing, wind from aerospace and batteries from consumer electronics. Solar energy is **10,000 times cheaper** today than when it was first used in the U.S.'s Vanguard satellite in 1958. Using a measure of cost that accounts for reliability and flexibility on the grid, the International Energy Agency (IEA) calculates that electricity from solar power with battery storage is less expensive today than electricity from new coal-fired plants in India and new gas-fired plants in the U.S. We project that by 2050 solar energy will **cost a tenth of** what it does today, making it far cheaper than any other source of energy. At the same time, barriers to large-scale clean energy use **keep tumbling**, thanks to advances in energy storage and better grid and demand management. And **innovations** are enabling the electrification of industrial processes with enormous efficiency gains [and]. The falling price of clean energy has **accelerated** its adoption. The growth of new technologies, from railroads to mobile phones, follows what is called an S-curve. When a technology is new, it grows exponentially, but its share is tiny, so in absolute terms its growth looks almost flat. As exponential growth continues, however, its share suddenly becomes large, making its absolute growth large too, until the market eventually becomes saturated and growth starts to flatten. The result is an S-shaped adoption curve. The energy provided by solar has been growing by about 30%

a year for several decades. In theory, if this rate continues for just one more decade, solar power with battery storage could **supply all the world's energy needs by** about **2035**. In reality, growth will probably slow down as the technology reaches the saturation phase in its S-curve. Still, based on historical growth and its likely S-curve pattern, we can predict that renewables, along with pre-existing hydropower and nuclear power, will largely displace fossil fuels by about 2050. For decades the IEA and others have consistently overestimated the future costs of renewable energy and underestimated future rates of deployment, often by orders of magnitude. The underlying problem is a lack of awareness that technological change is not linear but exponential: A new technology is small for a long time, and then it suddenly takes over. In 2000, about 95% of American households had a landline telephone. Few would have forecast that by 2023, 75% of U.S. adults would have no landline, only a mobile phone. In just two decades, a massive, century-old industry virtually disappeared. If all of this is true, is there any need for government support for clean energy? Many believe that we should just let the free market alone sort out which energy sources are best. But that would be a mistake. History shows that technology transitions often **need** a kick-start from **government**. This can take the form of support for basic and high-risk research, purchases that help new technologies reach scale, investment in infrastructure and **policies that create stability** for private capital. Such government actions have played a critical role in virtually every technological transition, from railroads to automobiles to the internet. In 2021-22, Congress passed the bipartisan CHIPS Act and Infrastructure Act, plus the Biden administration's Inflation Reduction Act (IRA), all of which provided significant funding to accelerate the development of the America's clean energy industry. Trump has pledged to end that support. The new administration has halted disbursements of $50 billion in already approved clean energy loans and put $280 billion in loan requests under review. The legality of halting a congressionally mandated program will be challenged in court, but in any case, the IRA horse is well on its way out of the barn. About $61 billion of direct IRA funding has already been spent. IRA tax credits have already attracted $215 billion in new clean energy investment and could be worth $350 billion over the next three years. Ending the tax credits would be **politically difficult,** since the top 10 states for clean energy jobs include Texas, Florida, Michigan, Ohio, North Carolina and Pennsylvania—all critical states for Republicans. Trump may find himself fighting Republican governors and members of Congress to make those cuts. It is **more likely that Trump** and Congress **will take actions that are politically easier,** such as ending consumer subsidies for electric vehicles or refusing to issue permits for offshore wind projects. The impact of these policy changes would be mainly to harm U.S. competitiveness. By reducing support for private investment and public infrastructure, raising hurdles for permits and slapping on tariffs, the U.S. will simply drive clean-energy investment to competitors in Europe and China. Meanwhile, Trump's promises of a fossil fuel renaissance ring hollow. U.S. oil and gas production is already at record levels, and with softening global prices, producers and investors are increasingly cautious about committing capital to expand U.S. production. The energy transition is a one-way ticket. As the asset base shifts to clean energy technologies, large segments of fossil fuel demand **will permanently disappear**. Very few consumers who buy an electric vehicle will go back to fossil-fuel cars. Once utilities build cheap renewables and storage, they won't go back to expensive coal plants. If the S-curves of clean energy continue on their paths, the fossil fuel sector will likely shrink to a niche industry supplying petrochemicals for plastics by around 2050. For U.S. policymakers, supporting clean energy isn't about climate change. It is about maintaining American economic leadership. The U.S. invented most clean-energy technologies and has world-beating capabilities in them. Thanks to smart policies and a risk-taking private sector, it has led every major technological transition of the 20th century. It should lead this one too.

Nuclear energy kills renewables and is comparatively worse on carbon.

CAN 24 [Climate Action Network, 3-18-2024, "POSITION PAPER: The nuclear hurdle to a renewable future and fossil fuel phase-out," Climate Action Network (CAN) Europe is Europe's leading NGO coalition fighting dangerous climate change. We are a unique network, in which environmental and development organisations work together to issue joint lobby campaigns and maximise their impact, https://caneurope.org/position-paper-nuclear-energy/] //Wenzhuo recut //cy

More than three-quarters of the EU's greenhouse gas emissions stem from our energy consumption, therefore it is vital to stop burning fossil fuels to limit temperature rise to 1.5°C, the Paris Agreement target. Together with members, and external experts, we developed our Paris Agreement compatible (PAC) energy scenario, which provides a robust, science-based pathway for Europe's energy landscape. On the basis of this work, CAN Europe advocates for a phase-out of coal by 2030, gas by 2035, and a 100% renewables-based energy system by 2040, which requires the phase-out of nuclear power by then. The disruption of nuclear power can be observed in many countries, not only in Europe. In Dubai, at COP28, CAN was strongly opposed to and called out countries, supporting and signing the pledge led by the USA, UK, France and 18 other countries to globally triple nuclear power in the next 25 years. This goal is much higher than the high bracket of International Energy Agency (IEA) scenarios, already based on improbable hypotheses and risks to distract from the tripling of Renewable Energy capacities that was agreed by a much larger group of countries at COP28. In 2023, there was an **alarming push** and a surge in support **for nuclear power** within the EU political space. This development is creating significant tension with proponents of energy sufficiency and a fully renewable energy system and marks a regressive step in efforts towards a sustainable and just energy transition. While nuclear champions claim that nuclear energy can work hand-in-hand with renewables, it is becoming increasingly clear that nuclear power acts as a significant hurdle to energy efficiency investments, the roll-out of renewables and fossil fuel phase-out in three spheres: the EU political debate, energy system planning, and decentralisation. Climate Action Network International, the global umbrella under which CAN Europe participates, with a community of almost 2000 members from civil society, in more than 130 countries, stands united in opposing new and existing nuclear power stations. In 2020, we reviewed and agreed the CAN Charta, the 'highest' document for all CAN members, the international secretariat and the regional nodes, and we listed under strategies "Promoting a nuclear-free future". A hurdle in the policy debate The starting gun for a renewed attempt at a nuclear renaissance was the inclusion of nuclear in the EU Taxonomy in 2022, and can be seen as the nuclear lobby's blueprint for its future ambitions – creating a large political debate using arguments of "technology neutrality" and a "level playing field" and forming alliances with fossil fuel advocates (in this case, fossil gas) in order to reduce ambition to sustainable solutions. Since then, a French-led campaign, manifested through the 14 Member State "Nuclear Alliance", coupled alongside the lobbying activities of the nuclear industry, has run roughshod through EU energy and climate policy over the last two years. Continuing the narrative of "technology neutrality" and a "level playing field", this mission has aimed at promoting nuclear energy at the direct expense of a transition to a 100% renewable-based energy system, in legislation such as the Renewable Energy Directive, Electricity Market Design and Net Zero Industry Act. Attempting to lower renewable ambition In the context of the Renewable Energy Directive (RED III) revision, France tested the waters in 2023 by calling for a low-carbon 'weighting' in EU renewables target in order to support a higher EU 2030 renewable energy target of 45%, where so-called 'low carbon' energy sources are taken into account when establishing national renewable energy targets. Though this did not see the light, a concession was won on renewable hydrogen and gained provisions to facilitate nuclear-produced hydrogen – risking further watering down a renewables-based technology pathway. The EU Commission launched its proposal for the Net Zero Industry Act (NZIA) in March 2023 as a response to the Inflation Reduction Act (IRA) of the United States. While nuclear was included as a list of technologies that were seen as making a contribution to decarbonisation, the EU Commission President, Ursula von der Leyen, refused to include it in the list of "strategic technologies", which could receive additional support. The list was limited, as to be better targeted, at technologies such as solar, wind, energy storage, heat pumps and grid technologies. The final political agreement has led to the inclusion of "nuclear fission energy technologies" as strategic, while this debate allowed the list to become so extensive it practically loses any strategic element. Delaying fossil phase out via dirty trade-offs During the Electricity Market Design reform, nuclear and fossil fuel promoters in the Parliament attempted to **derail** a deal supporting renewables and flexibility. In the Council, due to the focus of the Nuclear Alliance on the Contracts for Difference (supported by some coal dependent countries) the negotiations were delayed by several months and conversations redirected away from renewables, leading to a deal supporting subsidies for existing and new nuclear reactors and a prolongation of subsidies to coal power plants via capacity mechanisms. Wasting time and diverting attention As the nuclear debate **aggressively** dominates political negotiations, media, and public discourse, it **blatantly diverts critical attention from** advancing the **existing,** affordable, sustainable solutions to the energy transition. This overwhelming focus on nuclear power not only overshadows but also poses a risk of **derailing** the European **energy transition**, hindering progress towards aligning with the ambitious yet achievable goal of a **100% renewable energy** system by 2040. A hurdle to a fully renewables based power system CAN Europe's assessment of the draft National Energy and Climate Plans highlights that not a single Member State plan is aligned to a 1.5ºC compatible trajectory, nor minimum EU climate and energy requirements for 2030. **Increased ambition is required** on energy efficiency, energy savings, renewables and fossil fuels phase-out, while Member States are **betting on false solutions** to the challenge at hand, such as nuclear energy. As highlighted in our NECP analysis, the EU has inadequate renewables expansion, grossly insufficient investment in energy efficiency, late coal phase-out deadlines and gas dependence, while countries such as Bulgaria, Czechia, Estonia, France, Hungary, the Netherlands, Poland, Romania and Slovenia, are considering new nuclear that might never materialise. In 2023, Sweden has revised its 2040 target for 100% renewable electricity to 100% decarbonised electricity, to allow for continued and new nuclear power, and it is now clear that it can only happen with direct state aid. Italy, which voted against nuclear power in a referendum, is now investigating future nuclear power, while delaying quitting coal by 4 years. The largest nuclear power plant in Europe, the Zaporizhzhia Nuclear Power Plant in Ukraine, is currently occupied by the Russian military and Rosatom in an active warzone, but has not prevented Ukraine from including new nuclear power in its reconstruction. The Paris Agreement Compatible (PAC) scenario, on the other hand, emphasises renewables-based electrification, calling for determined and heightened attention to enable a 100% renewable-based EU energy system by 2040, and foresees no need for nuclear power in Europe. 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. 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. 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. 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. Finally, 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. New nuclear construction is too slow 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 projects in 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 2050, 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 does not support energy autonomy Nuclear power units equally fail to pass an "energy security" test, and run counter to the RepowerEU target of enhancing Europe's autonomy, given that more than 40% of the EU's Uranium is imported from Russia and no EU country is currently mining uranium within its own borders . Though Kazakhstan is seen as an alternative, its uranium industry is directly tied to Rosatom. While import bans have been placed on Russian coal and liquified natural gas, and Russian oil and natural gas have been targeted, this has not been the case for uranium. A hurdle to a decentralised future The declaration to triple nuclear power by 2050 signed by only 22 countries, 5 of which do not have nuclear reactors, on the sidelines of COP28 describes nuclear power as "source of clean dispatchable baseload power", a common message of the nuclear industry used to argue against a 100% renewable system and nuclear's use as a substitute for traditional fossil fuel generation. This claim, however, is misleading and outdated. Europe is moving beyond a highly centralised energy system, towards one which is decentralised, digitalised, and able to flexibly adjust to changing patterns of generation and consumption. In a 100%

renewable energy system, the need for traditional "baseload" power is obsolete and with distributed energy production, in a far more interconnected European Union, security of supply is better managed. 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. 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. Blocking renewables integration into the electricity grid The inflexibility of nuclear, caused by technical limitations, safety requirements and economic factors, **prevents the feed-in of renewable electricity** into the grid, causing grid congestion and curtailment. Nuclear's dominance over grid capacity can **block the connection of new renewable energy projects**, where even announced and then abandoned plans for a new nuclear unit can delay renewable projects connection, allowing for continued fossil fuel usage. Grid structures designed for large-scale, centralised nuclear power, make it more challenging, time-consuming and costly to introduce small-scale distributed renewable power. An example can be found in Romania where Cernavodă 3 and 4 reactors have reserved grid capacity for years, blocking new renewable energy projects in the Dobrogea region, the most wind-intensive region in the country. Delayed grid investments, due to uncertainty of new nuclear units, have also meant that capacity bottlenecks exist today for renewables online. In the Netherlands, the only current nuclear power station, Borssele is competing for landing space for off-shore electricity. Post-Fukushima, renewables were blocked from connecting to the grid in Japan as the government considered restarting the reactors, despite public opposition to nuclear restarts and support for renewables. Rather than taking the opportunity to invest in grids and integrate renewables twenty years ago, Japan still heavily relies on fossil fuels today. Prolonging the inevitable with nuclear extensions While European governments may be tempted to prolong existing nuclear reactors beyond their original foreseen lifespans, in the context of phasing out Russian gas, costly upgrades to the ageing nuclear fleet, just like investing in new ones, risks diverting investment away from more cost-effective solutions such as renewables, energy efficiency, and system flexibility, in addition to risking lowered safety standards and security of supply as ageing increases unplanned outages. Any prolongation of existing nuclear power plant units risks the continued crowding out of renewable energy sources from the electricity grid, preventing their price-dampening effects on the market. So-called "Small Modular Reactors" European lawmakers are increasingly persuaded by the empty promises of Small Modular Reactors (SMRs). Argued to be more flexible, decentralised, smaller, and cheaper than existing nuclear designs, countries are wasting public resources in favour of a non-existent product, 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. Nuclear energy is too risky and unsafe Nuclear technology inherently carries the risk of severe nuclear accidents with the release of large amounts of radioactivity as shown by catastrophic accidents in Fukushima or Chornobyl. **Extreme** and more frequent **weather** events due to climate change create **unprecedented** risks through storms or flooding that are not captured in planning standards for nuclear plants based on historic frequencies and severeness. Extreme weather events may also indirectly affect nuclear plants, such as breaking dams above nuclear plants or longer disconnection from electricity grids after storms. **Cyber attacks, military aggression** e.g. Russia's occupation of the Zaporizhzhia Nuclear Power Plant, and terrorist attacks, e.g. via drone attacks, could also lead to severe accidents of nuclear plants. Nuclear waste remains a risk worldwide to the health of all living creatures, including humans, for thousands of years after its use in energy production. Management of any future storage facility would still be at risk of natural disasters and decisions of future generations, whereas currently without any long-term solutions risks are increasingly shifting to interim storage which were not planned for the current supply and length of storage. Beyond decarbonisation For heightened climate ambition, renewables, energy efficiency, storage, interconnection and flexibility are best suited to make up this gap in generation and support increased renewables-based electrification, while phasing out fossil fuels in parallel. Given the poor speed and high costs of future nuclear projects, the difficulty to build several units at the same time, and the realities of SMRs, it is unlikely nuclear will be able to cover any significant part of Europe's energy needs by 2040. The future energy system will be far more decentralised, and active consumer and flexibility oriented, which are not the ideal conditions for new nuclear plants. For these reasons stated above, it is in the nuclear industry's interest to delay Europe's progress and keep in place the current centralised, fossil-based energy system, jeopardising climate goals, in the hope that projects are able to materialise in the future, and to lower safety standards to reduce costs. Nuclear energy is also at odds with an energy system based on democratic ownership of energy production, as opposed to renewables. A true democratic debate on nuclear has not been underway, but rather a capture by geopolitical interests and corporations. Problems in three identified spheres, the political debate, energy system planning, and decentralisation have been mapped as current and possible future areas where nuclear advocates may be actively hostile towards renewables and fossil fuel phase out. Though we must look beyond energy and decarbonisation, and have a holistic vision of nuclear power, incorporating drawbacks such as safety, waste, weapon proliferation, uranium dependency, operation in warzones and biodiversity.

AND, transitioning to nuclear will kill tens of millions per year

Jacobson 24 [Mark Z. (Professor of Civil and Environmental Engineering & Director of the Atmosphere/Energy Program @ Stanford University), "7 reasons why nuclear energy is not the answer to solve climate change," OneEarth, Oct. 10, 2024, https://www.oneearth.org/the-7-reasons-why-nuclear-energy-is-not-the-answer-to-solve-climate-change/)]DOA 03-17-2025//abhi☺***Ellipsis in OG***

There is a small group of scientists that have proposed replacing 100% of the world's fossil fuel power plants with nuclear reactors as a way to solve climate change. Many others propose nuclear grow to satisfy up to 20 percent of all our energy (not just electricity) needs. They advocate that nuclear is a "clean" carbon-free source of power, but they don't look at the human impacts of these scenarios. Let's do the math... One nuclear power plant takes on average about 14-1/2 years to build, from the planning phase all the way to operation. According to the World Health Organization, about 7.1 million people die from air pollution each year, with more than 90 percent of these deaths from energy-related combustion. So switching out our energy system to nuclear would result in about 93 million people dying**, as we wait** for all the new nuclear plants to be built in the all-nuclear scenario. Utility-scale wind and solar farms, on the other hand, take on average **only two** to five years, from the planning phase to operation. Rooftop solar PV projects are down to only a 6-month timeline. So transitioning to 100% renewables as soon as possible would result in tens of millions fewer deaths. This illustrates a major problem with nuclear power and why renewable energy -- in particular Wind, Water, and Solar (WWS) -- avoids this problem. Nuclear, though, doesn't just have one problem. It has seven. Here are the seven major problems with nuclear energy: 1. Long Time Lag Between Planning and Operation The time lag between planning and operation of a nuclear reactor includes the times to identify a site, obtain a site permit, purchase or lease the land, obtain a construction permit, obtain financing and insurance for construction, install transmission, negotiate a power purchase agreement, obtain permits, build the plant, connect it to transmission, and obtain a final operating license. The planning-to-operation (PTO) times of all nuclear plants ever built have been 10-**19 years or more**. For example, the Olkiluoto 3 reactor in Finland was proposed to the Finnish cabinet in December 2000 to be added to an existing nuclear power plant. Its latest estimated completion date is 2020, giving it a PTO time of 20 years. The Hinkley Point nuclear plant was planned to start in 2008. It has an estimated the completion year of 2025 to 2027, giving it a PTO time of 17 to 19 years. The Vogtle 3 and 4 reactors in Georgia were first proposed in August 2006 to be added to an existing site. The anticipated completion dates are November 2021 and November 2022, respectively, given them PTO times of 15 and 16 years, respectively. The Haiyang 1 and 2 reactors in China were planned to start in 2005. Haiyang 1 began commercial operation on October 22, 2018. Haiyang 2 began operation on January 9, 2019, giving them PTO times of 13 and 14 years, respectively. The Taishan 1 and 2 reactors in China were bid in 2006. Taishan 1 began commercial operation on December 13, 2018. Taishan 2 is not expected to be connected until 2019, giving them PTO times of 12 and 13 years, respectively. Planning and procurement for four reactors in Ringhals, Sweden started in 1965. One took 10 years, the second took 11 years, the third took 16 years, and the fourth took 18 years to complete. Many claim that France's 1974 Messmer plan resulted in the building of its 58 reactors in 15 years. This is not true. The planning for several of these nuclear reactors began long before. For example, the Fessenheim reactor obtained its construction permit in 1967 and was planned starting years before. In addition, 10 of the reactors were completed between 1991-2000. As such, the whole planning-to-operation time for these reactors was at least 32 years, not 15. That of any individual reactor was 10 to 19 years. 2. Cost The levelized cost of energy (LCOE) for a new nuclear plant in 2018, based on Lazard, is $151 (112 to 189)/MWh. This compares with $43 (29 to 56)/MWh for onshore wind and $41 (36 to 46)/MWh for utility-scale solar PV from the same source. This nuclear LCOE is an underestimate for several reasons. First, Lazard assumes a construction time for nuclear of 5.75 years. However, the Vogtle 3 and 4 reactors, though will take at least 8.5 to 9 years to finish construction. This additional delay alone results in an estimated LCOE for nuclear of about $172 (128 to 215)/MWh, or a cost 2.3 to 7.4 times that of an onshore wind farm (or utility PV farm). Next, the LCOE does not include the cost of the major nuclear meltdowns in history. For example, the estimated cost to clean up the damage from three Fukushima Dai-ichi nuclear reactor core meltdowns was $460 to $640 billion. This is $1.2 billion, or 10 to 18.5 percent of the capital cost, of every nuclear reactor worldwide. In addition, the LCOE does not include the cost of storing nuclear waste for hundreds of thousands of years. In the U.S. alone, about $500 million is spent yearly to safeguard nuclear waste from about 100 civilian nuclear energy plants. This amount will only increase as waste continues to accumulate. After the plants retire, the spending must continue for hundreds of thousands of years with no revenue stream from electricity sales to pay for the storage. 3. Weapons Proliferation Risk The growth of nuclear energy has historically increased the ability of nations to obtain or harvest plutonium or enrich uranium to manufacture nuclear weapons. The Intergovernmental Panel on Climate Change (IPCC) recognizes this fact. They concluded in the Executive Summary of their 2014 report on energy, with "robust evidence and high agreement" that nuclear weapons proliferation concern is a barrier and risk to the increasing development of nuclear energy: Barriers to and risks associated with an increasing use of nuclear energy include operational risks and the associated safety concerns, uranium mining risks, financial and regulatory risks, unresolved waste management issues, nuclear weapons proliferation concerns, and adverse public opinion. The building of a nuclear reactor for energy in a country that does not currently have a reactor allows the country to import uranium for use in the nuclear energy facility. If the country so chooses, it can secretly enrich the uranium to create weapons-grade uranium and harvest plutonium from uranium fuel rods for use in nuclear weapons. This does not mean any or every country will do this, but historically some have and the risk is high, as noted by IPCC. The building and spreading of Small Modular Reactors (SMRs) may increase this risk further. 4. Meltdown Risk To date, 1.5 percent of all nuclear power plants ever built have melted down to some degree. Meltdowns have been either catastrophic (Chernobyl, Ukraine in 1986; three reactors at Fukushima Dai-ichi, Japan in 2011) or damaging (Three-Mile Island in 1979; Saint-Laurent France in 1980). The nuclear industry has proposed new reactor designs that they suggest are safer. However, these designs **are** generally **untested**, and there is no guarantee that the reactors will be designed, built, and operated correctly or that a natural disaster or act of terrorism, such as an airplane flown into a reactor, will not cause the **reactor** to **fail**, resulting in a major **disaster**. 5. Mining Lung Cancer Risk Uranium mining causes lung cancer in large numbers of miners because uranium mines contain natural radon gas, some of whose **decay products** are **carcinogenic**. A study of 4,000 uranium miners between 1950 and 2000 found that 405 (10 percent) died of lung cancer, a rate six times that expected based on smoking rates alone. 61 others died of mining-related lung diseases. Clean, renewable energy does not have this risk because (a) it does not require the continuous mining of any material, only one-time mining to produce the energy generators; and (b) the mining does not carry the same lung cancer risk that uranium mining does. 6. Carbon-Equivalent Emissions and Air Pollution There is no such thing as a zero- or close-to-zero emission nuclear power plant. Even existing plants emit due to the **continuous mining** and **refining** of **uranium** needed for the plant. **Emissions** from new nuclear are 78 to 178 g-CO2/kWh, not close to 0. Of this, 64 to 102 g-CO2/kWh over 100 years are emissions from the background grid while consumers wait 10 to 19 years for nuclear to come online or be refurbished, relative to 2 to 5 years for wind or solar. In addition, all nuclear plants emit 4.4 g-CO2e/kWh from the water vapor and heat they release. This contrasts with solar panels and wind turbines, which reduce heat or water vapor fluxes to the air by about 2.2 g-CO2e/kWh for a net difference from this factor alone of 6.6 g-CO2e/kWh. In fact, China's investment in nuclear plants that take so long between planning and operation instead of wind or solar resulted in China's **CO2 emissions increasing** 1.3 percent from 2016 to 2017 **rather than declining** by an estimated average of 3 percent. The resulting **difference in air pollution** emissions may have caused **69,000 additional air pollution deaths** in China in **2016 alone**, with additional deaths in years prior and since. 7. Waste Risk Last but not least, consumed fuel rods from nuclear plants are radioactive waste. Most fuel rods are stored at the same site as the reactor that consumed them. This has given rise to hundreds of radioactive waste sites in many countries that must be maintained and funded for at least 200,000 years, far beyond the lifetimes of any nuclear power plant. The more nuclear waste that accumulates, the greater the risk of **radioactive leaks**, which can **damage water** supply, **crops**, **animals**, and **humans**.

Climate change is existential

Sears 21 [Nathan; April 2021; Ph.D. Candidate in Political Science at the University of Toronto, former Professor of International Relations at the Universidad de Las Americas, Trudeau Fellow in Peace, Conflict, and Justice at the Munk School of Global Affairs; Conference Paper for the International Studies Association, "Great Powers, Polarity, and Existential Threats to Humanity: An Analysis of the Distribution of the Forces of Total Destruction in International Security," p. 1-38]

Climate Change Humanity faces **existential** risks from the **large-scale destruction** of Earth's natural environment making the planet less hospitable for humankind (Wallace-Wells 2019). The decline of some of Earth's natural systems may already exceed the "planetary boundaries" that represent a "safe operating space for humanity" (Rockstrom et al. 2009). Humanity has become one of the driving forces behind Earth's climate system (Crutzen 2002). The major anthropogenic drivers of climate change are the burning of fossil fuels (e.g., coal, oil, and gas), combined with the degradation of Earth's natural systems for absorbing carbon dioxide, such as deforestation for agriculture (e.g., livestock and monocultures) and resource extraction (e.g., mining and oil), and the warming of the oceans (Kump et al. 2003). While humanity has influenced Earth's climate since at least the Industrial Revolution, the dramatic increase in greenhouse gas emissions since the mid-twentieth century—the “Great Acceleration” (Steffen et al. 2007; 2015; McNeill & Engelke 2016)— is responsible for contemporary climate change, which has reached approximately 1°C above preindustrial levels (IPCC 2018). Climate change could **be**come an **ex**istential **threat** to humanity if the planet’s climate reaches a “**Hothouse Earth**” state (Ripple et al. 2020). What are the dangers? There are two mechanisms of climate change that threaten humankind. The direct threat is extreme heat. While human societies possesses **some** capacity for **adaptation** and resilience to climate change, the physiological response of humans to heat stress imposes **physical limits**—with a hard limit at roughly 35°C wet-bulb temperature (Sherwood et al. 2010). A rise in global average temperatures by 3–4°C would increase the risk of heat stress, while 7°C could render some regions uninhabitable, and 11–**12**°C would leave much of the planet **too hot** for human **habitation** (Sherwood et al. 2010). The **indirect** effects of climate change could include, inter alia, rising **sea levels** affecting coastal regions (e.g., Miami and Shanghai), or even swallowing entire countries (e.g., Bangladesh and the Maldives); extreme and unpredictable **weather** and **natural disasters** (e.g., hurricanes and forest fires); environmental pressures on **water** and **food scarcity** (e.g., droughts from less-dispersed rainfall, and lower wheat-yields at higher temperatures); the possible inception of new bacteria and **viruses**; and, of course, large-scale **human migration** (World Bank 2012; Wallace-Well 2019; Richards, Lupton & Allywood 2001). While it is difficult to determine the existential implications of extreme environmental conditions, there are historic **precedents** for the **collapse of human societies** under environmental pressures (Diamond 2005). Earth’s “big five” mass extinction events have been **linked to** dramatic shifts in Earth’s **climate** (Ward 2008; Payne & Clapham 2012; Kolbert 2014; Brannen 2017), and a Hothouse Earth climate would represent terra incognita for humanity. Thus, the assumption here is that a Hothouse Earth climate could pose an existential threat to the habitability of the planet for humanity (Steffen et al. 2018., 5). At what point could climate change cross the threshold of an existential threat to humankind? The complexity of Earth’s natural systems makes it extremely difficult to give a precise figure (Rockstrom et al. 2009;). However, much of the concern about climate change is over the danger of crossing “**tipping points**,” whereby **positive feedback loops** in Earth’s climate system could lead to potentially **irreversible** and **self-reinforcing** “**runaway**” climate change. For example, the melting of Arctic “permafrost” could produce additional warming, as glacial retreat reduces the refractory effect of the ice and releases huge quantities of methane currently trapped beneath it. A recent study suggests that a “planetary **threshold**” could exist at global average temperature of **2°**C above preindustrial levels (Steffen et al. 2018; also IPCC 2018). Therefore, the analysis here takes the 2°C rise in global average temperatures as representing the lower-boundary of an existential threat to humanity, with higher temperatures increasing the risk of runaway climate change leading to a Hothouse Earth. The Paris Agreement on Climate Change set the goal of limiting the increase in global average temperatures to “well below” 2°C and to pursue efforts to limit the increase to 1.5°C. If the Paris Agreement goals are **met**, then nations would likely keep climate change **below the threshold** of an **existential** threat to humanity. According to Climate Action Tracker (2020), however, current policies of states are expected to produce global average temperatures of 2.9°C above preindustrial levels by 2100 (range between +2.1 and +3.9°C), while if states succeed in meeting their pledges and targets, global average temperatures are still projected to increase by 2.6°C (range between +2.1 and +3.3°C). Thus, while the Paris Agreements sets a goal that would reduce the existential risk of climate change, the actual policies of states could easily cross the threshold that would constitute an existential threat to humanity (CAT 2020).

T - Nuclear energy damages spacecraft and increases weight.

Cohen et al. 19 [S.A. Cohen, scholar and researcher @ JBIS with a focus on space and energy, 2-xx-2019, General interstellar issue, Journal of the British Interplanetary Society, Vol. 72, No. 2, https://www.bis-space.com/membership/jbis/2019/JBIS-v72-no02-February-2019-44lswo.pdf] BZ

3 FUEL CHOICE, NEUTRON PRODUCTION, AND POWER BALANCE

The production of neutrons by fusion is particularly problematic for spacecraft propulsion. Neutrons cause damage and activation of nearby materials and structures, limiting their lifetime, necessitating maintenance, and increasing the mass needed for shielding. Neutrons are hard to "direct", hence may contribute little to the thrust required of a rocket engine. Having all the fusion products be charged particles solves these problems at the added cost of requiring higher plasma temperatures because of the lower fusion cross sections of the "advanced" aneutronic fuels. Of the two aneutronic fuels most commonly discussed, we choose D-3 He instead of p-11B. The low energy release from p-11B fusion, plus the lower fuel density possible at fixed magnetic field (because of the higher nuclear charge) and the higher temperatures required, makes p-11B a dubious choice. However a penalty must be paid for selecting D-3 He. There are neutrons from one D-D fusion branch and possibly from the T fusion product of the other D-D fusion branch. Methods must be found to ameliorate these effects.

Imp. T - Space cololization bad.

Ryan **Gunderson** et al. September 20**21**, [Ryan Gunderson, Diana Stuart, and Brian Petersen, * Assistant Professor of Sociology and Social Justice Studies in the Department of Sociology and Gerontology at Miami University, ** Assistant Professor in the Sustainable Communities Program and in the School of Earth Sciences and Environmental Sustainability at Northern Arizona University, *** Assistant Professor in the Department of Geography, Planning, and Recreation at Northern Arizona University, "In search of plan(et) B: Irrational rationality, capitalist realism, and space colonization," 2021, Future, Vol. 134, https://doi.org/10.1016/j.futures.2021.102857, EA & -zc-]

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4.1. The irrational rationality of space colonization

While there are incredible challenges that could potentially limit visions of space colonization, our focus is to examine if space colonization is rational in terms of preserving the human species from the escalating existential threats on Earth. From what we know, does space colonization represent an effective and efficient way to protect the human species? How rational are the justifications for space colonization to save the human species on their own instrumental grounds? We argue the following: (1) that **alternatives** to Earth are obviously **far more inhospitable** for human life than Earth and, thus, preserving Earth is more instrumentally rational; (2) if the goal of space colonization is to preserve the human species, then it is **more** instrumentally **rational to** save many **more lives on Earth** than create space colonies for a small population who can afford the ticket; and, most importantly, (3) there is reason to predict that **humans** would **take** an **irrational** rational **logic with them** to space, the same rationality **that oversaw the destruction** of Earth and brought them off-planet in the first place. The point is to develop an immanent critique of the instrumental case for space colonization to show the extent to which this form of logic is still unreasonable, even judged by its own means-oriented criteria.

While space colonization is justified to avoid risks and threats on Earth, **there will be new risks** and threats in space – some that are even **more severe.** Kovic (2020) discusses some of these risks and in certain scenarios the **risks** of space travel and colonization **greatly outweigh the risks of staying on Earth and the benefits of colonizing space**. Kovic (2020): 3) explains,

[i]n general, there are two ways in which space colonization-related risks might affect the long-term future of humankind. First, humankind might become more susceptible to existing (existential) risks. Second, space colonization itself might create new (existential) risks that could result in highly undesirable or even catastrophic outcomes.

Kovic (2020) in the end argues that prioritizing space colonization as a survival strategy overlooks or ignores the high probability of existential threats and risks in space. The **rapid creation of new technologies for space living may also create unexpected consequences and risks that could undermine or threaten space**

colonization. For example, on Mars, hostile conditions including dust storms, sub-freezing night time temperatures, and lack of water or carbon-dioxide to grow plants (Szocik, Wójtowicz, Rappaport, & Corbally, 2020) could result in death, starvation, cannibalism and extremely stressful survival decisions causing "astronomical amounts" of suffering (Torres, 2018: 75).

In addition, the space colonies currently proposed still would not protect humans from large-scale stellular events like supernovae or an expansion of the sun. As explained by Stoner (2017) in the context of a Mars colony, the same risks as well as new risks make the colony very dangerous and protective measures would be immensely expensive in a cost-benefit analysis:

[i]f the goal is species survival, and given that the Martian environment is much less survivable than even a post-strike Earth would be, then there is no remotely realistic budget point at which the marginal dollar would be more effectively spent on Mars colonization than on protecting Earth and the creatures and civilizations that evolved to live within its shelters.

Stoner (2017) goes on to argue that the analysis for the operations of projects like those of SpaceX, "only appears rational because they have carefully loaded the comparison scenarios in a way that guarantees a pro-colonization conclusion." While space colonization may be a better preservation strategy than doing nothing, **there are many more options that are less risky and more likely to preserve a greater number of human lives.**

Another commonly overlooked aspect of space colonization as a species survival strategy is the fact that **not everyone will be able to go**, and many of Earth's commoners and poor will likely be left on Earth. Only a portion of the human population would be able to live off-planet, perhaps only the economic elite. It is not unreasonable to assume that,. if there are large inequalities in power and wealth, that the most wealthy will be in power and that these elites will decide to be the "lucky" few space settlers. It is not possible for Mars, for example, to provide a safe habitat for all humans on Earth. Thus, a possible scenario is economic elites leaving behind the vast majority of humans on an inhospitable Earth. As Billings (2019: 45) questions, "how many poverty-stricken Bangladeshis, how many sub-Saharan Africans, how many permanently displaced Syrian refugees, how many disabled and unemployable workers could come up with $200,000 – or $2,000,000 for that matter – to move to another planet and start a new life. What are the ethics of giving the rich yet another advantage over the poor? What are the ethics of ignoring the need to check the rapid pace of climate change on our own planet?"

Under capitalism, any solution to crises on Earth focused on moving off-planet will likely exclude the masses and the poor. Are these lives not worth saving? Are there **other strategies** that **would save more lives**?

Saving the most present and future human lives would require addressing the threats on Earth, including climate change, biodiversity loss, poverty, disease, and famine. As stated by Kovic (2020: 6), "[g]iven these acute problems, pursuing space colonization today could be a misguided use of limited resources." He poses the following question: If the goal is to save as many lives and to maximize overall wellbeing, then why focus on an alternative that only benefits a very small population, while the vast majority struggle to survive or perish? Others argue that much more than human lives need to be saved to live successfully off-planet; we need a diversity of other organisms and a measurable portion of the Earth's biodiversity (Johnson, 2019). Given the **rate of existential threats** like climate change, **how much time is there** to develop this technology and transport all people and enough other organisms off-planet? If the goal is species survival, the **time** (**and** the immense **resources** required) **could be spent in more effective ways** to benefit all people and species. However, these alternatives are unseen or considered impossible in the context of capitalist realism (see proceeding section).

Lastly, the current social order dominating human-human and human-material relations (**capitalism**) is **likely to result in negative outcomes and problems even off-planet.** For example, mining and development on Mars would very likely be environmentally destructive as colonization is unlikely to have a light impact on the planet (Stoner, 2017). We would bring these relations and the associated problems with us. As Marino (2019: 15) explains,

[i]n Musk's view we need a back-up planet. But he doesn't acknowledge that **we** ourselves **are the cause** of this dire situation. And therein lies the problem and the reason we, as a species, have no business trying to colonize another planet. Musk's reason for wanting to colonize Mars is to save ourselves from ourselves and it is self-evident that this alone recommends we should not be going anywhere.

There is no reason to assume that we have learned our lesson on Earth and will create a new civilization with better outcomes, when the same system and drivers (namely, capital accumulation) continue to dominate the social order.

Billings (2019) reminds us that while one may wish to "start fresh" in a new colony, **humans will take the drivers of crises and collapse with them.** These drivers and forms of logic are precisely why humans find themselves discussing the possibility of moving off-planet in the first place. This fact should inspire collective reflection and deliberative discussions on the purpose of life and **alternative** ways of organizing social relations to achieve this purpose. However, for irrational rationality, the latter substantive questions answered through communicative action are an irrelevant waste of time - at best, “mere opinion.” In contrast, the ostensibly “practical” and “realistic” technological rationality responds by designing ever-more sophisticated technics for the irrationally rational purpose of rushing off to space to continue the instrumental crusade of blind domination. This is the elevation of means to ends, the irony of contemporary instrumental reason diagnosed by the Frankfurt School. Rather than serving a better world, technological development and production today are ends to be pursued for their own sake. That is, because we can no longer set aims through reasonable criteria, we pursue aims, such as economic growth and technological development, that are set by a semi-autonomous economic system. For the Frankfurt School, these are irrational conditions because **technology and economic activity should be instruments to serve humanity, rather than humanity serving technology and economic activity.**

In summary, the **associated risks, inequities, and costs do not support the argument that space colonization is an effective and efficient strategy to preserve the species from existential threats on Earth.** The polemical point here is to highlight how the heights of instrumental rationality—hi-tech plans to colonize space to ensure species survival—are irrational because the case for space colonization: (1) fails to make a convincing instrumental case on its own grounds (i.e., space colonization is not an efficient and effective means to safeguard the species) and, (2) by elevating means (namely economic activity) to ends, exhibits the same kind of logic that caused the Earth-bound problems that space colonization is responding to. The inversion of means and ends is examined further in the context of capitalist realism.

NU - Investment now.

Cassauwers ’24 [Tom; Freelance Journalist; February 29; Al Jazeera; “Is nuclear power the key to space exploration?,” https://www.aljazeera.com/economy/2024/2/29/is-nuclear-power-the-key-to-space-exploration; DOA: 3-27-2025] tristan

Long a controversial energy source, nuclear has been experiencing renewed interest on Earth to power our fight against climate change. But behind the scenes, nuclear has also been facing a renaissance in space.

In July, the US National Aeronautics and Space Administration (NASA) and Defense Advanced Research Projects Agency (DARPA) jointly announced that they plan to launch a nuclear-propelled spacecraft by 2025 or 2026. The European Space Agency (ESA) in turn is funding a range of studies on the use of nuclear engines for space exploration. And last year, NASA awarded a contract to Westinghouse to develop a concept for a nuclear reactor to power a future moon base.

“There’s a lot of interest in nuclear for space applications at the moment,” said Dr Ramy Mesalam, programme director of spacecraft engineering at the University of Leicester. “The deeper we explore our solar system and beyond, the more attractive nuclear will become.”

NL - Laws of physics preclude travel.

Robinson 16 [Kim Robinson, Scientific American.] “What Will It Take for Humans to Colonize the Milky Way?” 13 January 2016 (https://www.scientificamerican.com/article/what-will-it-take-for-humans-to-colonize-the-milky-way1/)

The idea that humans will eventually travel to and inhabit other parts of our galaxy was well expressed by the early Russian rocket scientist Konstantin Tsiolkovsky, who wrote, “Earth is humanity’s cradle, but you’re not meant to stay in your cradle forever.” Since then the idea has been a staple of science fiction, and thus become part of a consensus image of humanity’s future. Going to the stars is often regarded as humanity’s destiny, even a measure of its success as a species. But in the century since this vision was proposed, things we have learned about the universe and ourselves combine to suggest that moving out into the galaxy **may not be humanity’s destiny after all.** The problem that tends to underlie all the other problems with the idea is the sheer size of the universe, which was not known when people first imagined we would go to the stars. Tau Ceti, one of the closest stars to us at around **12 light-years** away, is 100 billion times farther from Earth than our moon. A quantitative difference that large turns into a qualitative difference; we can’t simply send people over such immense distances in a spaceship, **because a spaceship is too impoverished an environment to support humans**

for the time it would take, which is on the order of centuries. Instead of a spaceship, we would have to create some kind of space-traveling **ark**, big enough to support a community of humans and other plants and animals in a fully recycling ecological system. On the other hand it would have to be **small** enough to **accelerate to a fairly high speed**, to shorten the voyagers' time of **exposure to cosmic radiation**, and to **breakdowns** in the ark. Regarded from som e angles bigger is better, but the bigger the ark is, the proportionally more **fuel** it would have to carry along to slow itself down on reaching its destination; this is a vicious circle that **can't be squared**. For that reason and others, smaller is better, but smallness creates problems for resource metabolic flow and ecologic balance. Island biogeography suggests the kinds of problems that would result from this miniaturization, but a space ark's isolation would be far more complete than that of any island on Earth. The design imperatives for bigness and smallness may cross each other, leaving any viable craft in a non-existent middle. The biological problems that could result from the radical miniaturization, simplification and isolation of an ark, no matter what size it is, now must include possible impacts on our microbiomes. We are not autonomous units; about eighty percent of the DNA in our bodies is not human DNA, but the DNA of a vast array of smaller creatures. That array of living beings has to function in a dynamic balance for us to be healthy, and the entire complex system co-evolved on this planet's surface in a particular set of physical influences, including Earth's gravity, magnetic field, chemical make-up, atmosphere, insolation, and bacterial load. Traveling to the stars means leaving all these influences, and trying to replace them artificially. What the viable parameters are on the replacements would be **impossible** to be sure of in advance, as the situation is **too complex to model**. Any starfaring ark would therefore be an **experiment**, its inhabitants lab animals. The first generation of the humans aboard might have volunteered to be experimental subjects, but their descendants would not have. These generations of descendants would be born into a set of rooms a trillion times smaller than Earth, with no chance of escape. In this radically diminished enviroment, rules would have to be enforced to keep all aspects of the experiment functioning. Reproduction would not be a matter of free choice, as the population in the ark would have to maintain minimum and maximum numbers. Many jobs would be mandatory to keep the ark functioning, so work too would not be a matter of choices freely made. In the end, sharp constraints would force the social structure in the ark to enforce various norms and behaviors. The situation itself would require the establishment of something like a totalitarian state. Of course sociology and psychology are harder fields to make predictions in, as humans are highly adaptable. But history has shown that people tend to react poorly in rigid states and social systems. Add to these social constraints permanent enclosure, exile from the planetary surface we evolved on, and the probability of health problems, and the possibility for psychological difficulties and mental illnesses seems quite high. Over several generations, it's hard to imagine any such society staying stable.

T - SMRs invite cyberattacks.

Gray 23 [Cristina Siserman-Gray, Legal and regulatory specialist @ Pacific Northwest National Laboratory, 5-12-23, Cybersecurity for Small Modular Reactors (SMRs): Regulatory Challenges and Opportunities, Pacific Northwest National Laboratory, https://resources.inmm.org/sites/default/files/2023-07/finalpaper_378_0512115036.pdf, Willie T.]

Small Modular Reactors (SMRs) are a class of advanced nuclear fission reactors comprised of factory-built components and systems that are transported as modules and installed at a licensee's site. The term SMR reflects the size, capacity, and modularity of the construction of the reactor and is not indicative of the specific nuclear process used within the design. The International Atomic Energy Agency (IAEA) defines SMRs as reactors with electric generating capacity of 300 megawatts (MWe) and below. SMRs are considered to be the nuclear energy of the future. It is believed that this type of reactors could be key in helping countries achieve their net-zero goals, as they are estimated to be less expensive and safer to operate than traditional nuclear reactors which typically produce more than 500 MWe1. If successfully deployed, SMRs will provide clean energy integration with the grid, while working synergistically with renewable energy sources such as solar and wind2

Today, most existing nuclear power plants (NPP) around the world use a combination of digital and analog systems to monitor, operate, control and protect the facility3. Digital assets, systems, and networks associated with safety-related and security functions are typically air-gapped or protected from cyber threats originating from non-plant or external networks, including the Internet4, by implementing security controls such as datadiodes and firewalls. However, it is important to recognize that, while an air gap can introduce additional complexity into the attack path planning, it will **not stop all malicious attacks**, and facilities continue to be exposed to cybersecurity vulnerabilities.5 Incidents of cyber-attacks on computer systems, across **all industries**, are a common occurrence and are reported regularly in the media6 . In the past decades, several reports7 exposed the growing risk of a cyber-attack on civil nuclear facilities because of the increased reliance on digital systems and the growing use of "off-the-shelf" software and equipment, as well as vulnerabilities in the supply chain8.

Similar to traditional nuclear power plants, SMRs designs anticipate the use of semi-autonomous or **highly automated** control systems composed of **digital components** such as wireless monitoring, digital communications, remote or shared data processing and modern control-system components9 . With new SMRs designs anticipating a potential for remote use, portability of the systems, and critical digital process control, the existing design-basis threat analysis will have to be adapted to account for disruptive failures of automated technology and malicious threats, such as targeted cyberattacks. In this context, cyber-physical security risk management for SMRs is an active area of **research** and regulatory concern.

SMR concepts are currently at very different stages of development. While most of them only exist as concept studies, in several countries, SMR designs have already been certified by regulatory authorities on their safety design, and contracts for the construction of such plants have been signed (e.g., USA, Britain, Romania or Poland). Given that many governments are just beginning to grapple with the emerging cybersecurity risk specific to nuclear industry, regulatory standards are insufficient in addressing cybersecurity. In effect, only a small number of countries have issued regulatory requirements or other standards on cybersecurity at nuclear facilities, and even the few existing ones, do not contain specific cybersecurity references to SMR technology10. While this is understandable, given that the SMR technology is relatively new, it is however recommended that special attention is dedicated to this area as more regulators will have to go through the process of certifying SMRs as more designs are developed. This paper first identifies and analyses several cybersecurity vulnerabilities applicable to SMRs. Then, it highlights several cybersecurity national regulatory approaches and best practices that international organizations and several countries have proposed to address these challenges. Lastly, it identifies a series of recommendations on how these cybersecurity challenges could be potentially mitigated from a legal and regulatory perspective.

2. Cybersecurity risks and vulnerabilities for SMRs SMRs are expected to be very flexible as they can be scaled up or down to meet the energy demands and help power areas where larger plants are not needed. Yet, these nuclear technologies can be very different from the current operating nuclear fleet, as they are **relying on digitally controlled operations, miniaturization of components, wireless and automated technologies**, as well as artificial intelligence, all providing the promise of delivering innovative solutions for complying with nuclear security standards for SMRs11. At the same time, their use also presents several significant cybersecurity challenges, which will be discussed in the following section.

2.1 Remote Supervisory Control It appears that many companies developing SMRs intend to operate them in a mostly remote manner. This is likely driven by the potential for cost savings. Some potential use-cases for SMRs may include siting these reactors in "**off-grid" locations** such as isolated communities, remote mining camps, and distant industrial sites that require consistent and reliable power generation. Use of **SMRs in such environments would necessitate remote operation** and monitoring of the deployed reactors by licensed operators presumably **located a considerable distance** from the site. This poses a challenge as existing IAEA guidance effectively recommends that “command and control” of the reactor be conducted from a main control room located within the protected area of a site by a sizeable team of licensed operators12. Until now, the subject of remote operation of a commercial nuclear reactor was never envisioned or contemplated. As such, it represents a “paradigm shift” with respect to traditional nuclear plant operations13 .

Cyber security regulations associated with traditional NPPs characteristically require licensees to develop, apply, and maintain defense-in-depth protective strategies capable of detecting, responding to, and recovering from cyber-attacks. Central to these strategies is the implementation of a data flow model defining acceptable types of communications flowing between digital systems maintained at different security levels within the facility14. To facilitate such data transfer, it is recommended that licensees implement a robust Defensive Computing Security Architecture (DCSA) using devices and mechanisms to ensure that systems performing significant safety and security functions have the requisite level of protection15. Communications necessary to support command and control functions from an offsite location (e.g., a remote-control room) appear to be incompatible with SMRs data flow models.

Remote operation of SMRs also **creates an adversarial pathway** or vector of attack that was otherwise mitigated by onsite control rooms. Because control of the physical communications medium extends **far beyond the physical boundaries** of the site, it no longer inherits the benefits of the plant’s Physical Protection System (PPS). As such, certain disruptive attacks **cannot be effectively prevented** and may not be **responded to in a timely** manner. The severity of such an event is dependent upon the systems involved, the functions that they provide, and consequences resulting from loss or impairment of those functions.

T - <u>Uranium</u> and <u>released vapors</u> increase emissions.

Jacobson 24 [Mark Z. Jacobson, Professor of Civil and Environmental Engineering @ Stanford, 10-10-2024, 7 reasons why nuclear energy is not the answer to solve climate change, One Earth, https://www.oneearth.org/the-7-reasons-why-nuclear-energy-is-not-the-answer-to-solve-climate-change/, Willie T.]

6. Carbon-Equivalent Emissions and Air Pollution

There is **no such thing** as a zero- or close-to-zero emission nuclear power plant. Even existing plants emit due to the **continuous mining and refining of uranium** needed for the plant. Emissions from new nuclear are 78 to 178 g-CO_2/kWh, **not close to 0.** Of this, 64 to 102 g-CO_2/kWh over 100 years are emissions from the background grid while consumers wait 10 to 19 years for nuclear to come online or be refurbished, relative to 2 to 5 years for wind or solar. In addition, all nuclear plants emit 4.4 g-CO_2e/kWh from the **water vapor and heat they release**. This **contrasts** with solar panels and wind turbines, **which reduce** heat or water vapor fluxes to the air by about 2.2 g-CO_2e/kWh for a **net difference** from this factor alone of **6.6 g-CO_2e/kWh.**

In fact, China's investment in nuclear plants that **take so long** between planning and operation instead of wind or solar resulted in China's CO_2 emissions **increasing 1.3 percent** from 2016 to 2017 **rather than declining** by an estimated average of 3 percent. The resulting difference in air pollution emissions may have caused **69,000 additional air pollution deaths** in China in 2016 alone, with additional deaths in years prior and since.

For nuclear power to solve warming uranium has to be mined <u>first</u> --- we cross <u>irreversible tipping points</u> before solving AND prefer this on <u>probability</u> because it's <u>historically verified</u>.

Alt LT – LT. Nuclear is <u>too slow</u> and raises <u>net emissions</u>.

Ramana 24 [M.V. Ramana, Simons Chair in Disarmament, Global and Human Security and Professor of Public Policy and Global Affairs @ University of British Columbia, 7-29-2024, "Atomic Fallacy: Why Nuclear Power Won't Solve the Climate Crisis" Literary Hub, https://lithub.com/atomic-fallacy-why-nuclear-power-wont-solve-the-climate-crisis/, accessed: 4-1-2025] OA

Some might argue that these risks are the price we must pay to counter the threat of climate change. I disagree, but even if one were to adopt this position, my **research** shows that **nuclear energy** is just **not** a **feasible solution** to climate change. A nuclear power plant is a **really expensive** way to produce electricity. And nuclear energy simply cannot be scaled **fast enough** to match the rate at which the world needs to **lower carbon emissions** to stay under 1.5 degrees Celsius, or even 2 degrees.   Cost and the slow rate of deployment largely explain why the share of global **electricity** produced by nuclear reactors has been **steadily declining**, from around 16.9 percent in 1997, when the Kyoto Protocol was signed, to 9.2 percent in 2022. In contrast, as the costs of **wind** and **solar** energy **declined dramatically**, and modern renewables (which do not include large dams) went from supplying 1.2 percent of the world's electricity in 1997 to **14.4 percent** in 2022.   Another contrast is revealing. When pro-**nuclear advocates** talk about solving climate change with **nuclear energy**, they call for building **lots and lots** of reactors. The World Nuclear Association, for example, proposes building **thousands** of nuclear reactors, which would together be capable of generating a million megawatts of electricity, by **2050**. Such a goal is completely at odds with **historical rates** of building nuclear **reactors.**   Some proponents of nuclear energy refuse to give up on the technology. They blame the decline in nuclear energy and the high costs and long construction periods on the characteristics of older reactor designs, arguing that alternative designs will rescue nuclear energy from its woes. In recent years, the alternatives most often advertised are small modular (nuclear) reactors—SMRs for short. These are designed to generate between 10 and 300 megawatts of power, much less than the 1,000–1,600 megawatts that reactors being built today are designed to produce.   For over a decade now, many of my colleagues and I have consistently explained why these reactors would not be **commercially viable** and why they would never resolve the **undesirable consequences** of building **nuclear power plants.** I first started examining small modular reactors when I worked at Princeton University's Program on Science and Global Security. Our group largely comprised physicists, and we used a mixture of technical assessments, mathematical techniques, and social-science-based methods to study various problems associated with these technologies. My colleague Alex Glaser, for example, used neutronics models to calculate how much uranium would be required as fuel for SMRs, which we then used to estimate the increased risk of nuclear weapons proliferation from deploying such reactors. Zia Mian, originally from Pakistan, and I showed why the technical characteristics of SMRs would not allow for simultaneously solving the four key problems identified with **nuclear power**: its high **costs**, its **accident risks**, the difficulty of dealing with **radioactive waste**, and its linkage with the capacity to make **nuclear weapons**. My colleagues and I also undertook case studies on Jordan, Ghana, and Indonesia, three countries advertised by SMR vendors as potential customers, and showed that despite much talk, none of them were investing in SMRs, because of various country-specific reasons such as public opposition and institutional interests. We were not the only people coming up with reasons for not believing in the claim that new reactor designs would solve all these problems. Other scientists and analysts also highlighted the dangers and false promises of SMRs. Nuclear advocates are not deterred by such arguments. They **insist** that this time it will be **different**. Nuclear plants would be cheap, would be quick to build, would be safe, would never have to be shut down in unplanned ways, and would not be affected by climate-related extreme weather events. The evidence from the **real world**, which I elaborate on later, suggests **otherwise**. Nuclear reactors are unlikely to possess any of these characteristics, let alone all of them. Thus, what is actually being advocated might be termed faux nuclear plants, existing only in the imagination of some, not in the real world. My bottom line is that nuclear energy, whether with **old reactor designs** or **new faux alternatives**, will simply **not** resolve the **climate crisis**. The threat from **climate change** is **urgent**. The world has neither the **financial resources** nor the luxury of **time** to **expand nuclear power**. Meanwhile, even a limited expansion would aggravate a range of **environmental** and **ecological risks**. Further, nuclear energy is deeply imbricated in creating the conditions for nuclear annihilation. Expanding nuclear power would leave us in the **worst** of **both worlds**.

Card they read says peak oil will occur in the next 5-6 years. Nuclear power is just too slow to respond