## First argument economy

## **The market’s sustainable now. P&S 25**

**P&S 25** [P&S Intelligence, P&S Intelligence is a leading market research and consulting services provider to clients across the globe, xx-xx-2025, U.S. Nuclear Power Market Size, Share & Trends Analysis, 2032, P&S Intelligence, https://www.psmarketresearch.com/market-analysis/us-nuclear-power-market, accessed 3-21-2025.] //aayush

**U.S. Nuclear Power Market Overview The U.S. nuclear power market valued USD 13.3 billion in 2024**, and **this number is expected to increase to USD 19.6 billion by 2032, advancing at a CAGR of 5.1% during 2025–2032**. The **market is driven by the growing demand for electricity due to a burgeoning population, rampant urbanization and industrialization, and booming construction sector**. Amidst all this, the rising emissions of GHGs and the country’s efforts to limit them drives the demand for green energy. The **existing nuclear reactors sustain the nation's electricity supply to a considerable degree, but must deal with higher operational expenses and several regulatory constraints.** Therefore, plant life is being expanded through modern techniques and advanced nuclear reactors, including small modular reactors, are being deployed. U.S. Nuclear Power Market Dynamics **Small Modular Reactors Are Biggest Trends** Small modular reactors (**SMRs**) **are attracting increasing interest because of their reduced costs and adaptive nature**. SMR development is **led by major power companies, such as NuScale, GE Hitachi, Toshiba, and Rolls-Royce. In January 2024, NuScale Power's VOYGR received the U.S. Nuclear Regulatory Commission certification**. Several small modular reactor installations at existing nuclear power facilities are currently in planning or execution. **In October 2024, Amazon.com Inc. announced three agreements in the area of SMRs**. The agreement with Energy Northwest in Washington state will entail the development of four advanced SMRs with a capacity of 320 Megawatts in the first phase and ultimate capacity of 960 MW. **The reactors will be developed by X-energy, which Amazon announced a significant investment to enable 5 GW of capacity. Amazon also signed an agreement** with utility company Dominion Energy **to develop SMRs** near the latter’s nuclear power station in North Anna. **The project will produce around 300 MW of nuclear power for the residents of Virgina**. Just like the conventional high-capacity reactors, SMRs are ideal for power generation, heat production, desalination, desalination, and many other purposes. The DoE is currently engaged in the development of SMRs cooled by light water, which would further bring down the cost of the technology. Moreover, they are being designed to be simpler in design yet highly safe. **Rising Demand for Clean Energy Propels Market** Nuclear power plays a crucial role in meeting the expanding electrical requirements due to **population increase, demand for transport electrification, and industrial growth**. **Nuclear power generates about 18% of the national electricity and almost 50% of the nation's emission-free electricity**. In 2023, 775 billion kilowatt-hours of nuclear power was produced in the country, as per the EIA. In 2024, utility-scale nuclear power plants in the U.S. had a cumulative capacity of 96,402.8 MW. The high operating efficiency of nuclear power plants enhances economic performance, which enables a stable and continuous power supply. As per the DoE, **nuclear power plants boast a capacity factor** (duration for which they operate at full power) of over 92%. This is on contrast to 56% for natural gas, 41% for hydropower, 40% of coal-based, 35% of wind, and 25% of solar power plants. **The price competition for nuclear power stands strong when compared to different forms of electrical power generation specifically in areas with limited easy access to cheap fossil fuel sources**. The **market is seeing increasing investment because the government at the federal and state levels supports nuclear power through tax credits, research and development funding, and loan guarantees**. The biggest reason behind this is the high GHG emissions of the U.S., which are only behind those of China. As per the EPA, the country emitted 6,343 million tCO2e of emissions in 2022, which is why it is aiming for a zero-emission grid by 2030.

#### In fact, demand increases are almost too quick — we’re on the brink. Szafron 25

**Szafron 25** [Jeremy Szafron, Kitco.com. “Uranium’s Turning Point: Supply Squeeze, AI Demand, and the Nuclear Energy Boom - Scott Melbye,” Mar 18, 2025. https://www.kitco.com/news/article/2025-03-18/uraniums-turning-point-supply-squeeze-ai-demand-and-nuclear-energy-boom. A graduate of Concordia University with a BA in Journalism, Jeremy's academic background laid the foundation for his diverse and dynamic career. Now, as an Anchor at Kitco News, Jeremy will continue to inform a global audience of the latest developments and critical themes in finance and commodities.] //arrguy

‌(Kitco News) - **The uranium market is at a breaking point, caught between skyrocketing demand for nuclear power and a crippling supply deficit. As data centers, AI, and national security concerns drive unprecedented energy consumption, the need for uranium has never been greater.** At the 2025 PDAC conference in Toronto, Scott Melbye, CEO of Uranium Royalty Corp. and EVP of Uranium Energy Corp., laid out the stakes: “The last three, four years and currently where we are today, I’ve never seen a better narrative around nuclear power, behind uranium.” Melbye, a 41-year veteran of the uranium sector, has seen boom-and-bust cycles, but this time is different. **“We’re building nuclear power plants and we’re proposing new nuclear power plants faster than we’re bringing on new uranium supply.”** Global uranium demand is surging – but supply isn’t keeping up The world is rapidly shifting toward nuclear power, with over 30 countries and 160 corporations pledging to triple nuclear power by 2050. “We now have… we’ve gone from a flat market where nuclear energy wasn’t growing or even declining after Fukushima to a point now where nuclear energy’s looking to double by 2040,” Melbye said. But supply isn’t keeping up with demand. “We need new mines tomorrow, and the easier mines, if there is such a thing in mining, are the restart of operations,” he said. “The U.S. needs baseload demand growth for electricity again, and data centers are making that an even greater challenge.”

#### Thus, sudden government investment would be devastating. Karasa 25

**Karasa 25** [Ignas Mikalauskas and Darius Karaša, Kaunas Faculty, Vilnius University, Muitines Street 8, 44280 Kaunas, Lithuania; Lithuanian Energy Institute, Breslaujos Street 3, 44403 Kaunas, Lithuania, 3-12-2025, The Risk of Financial Bubbles in Renewable Energy Markets, No Publication, https://www.mdpi.com/1996-1073/18/6/1400/pdf?version=1741778052, accessed 3-18-2025.] //aayush

**Particularly in high-growth industries such as solar** photovoltaics (PV) **and battery** storage, the **results of this study show that markets for renewable energy are prone to financial saturation and speculative bubbles**. The results underline the need for spotting bifurcation points (~70% saturation) and overheating phases (~90% saturation) to reduce **investment risk**. This part compares results with previous studies, places them in the larger framework of financial and energy policies and presents policy and investment ideas meant to stop financial instability.

5.1. Comparison with Existing Literature

**Bubbles in RE have not been deconstructed to identify their embedded pattern** and have not been evaluated through a **new perspective of capital flows, investments, and possible financial saturation in the market**. So far, **there has been no assessment of the impact on the invested capital and how it could affect the markets**. Although the **authors analyze the bubble** (e.g., Green Bubbles), **the analyses do not include financial saturation and the impact of capital/investment on bubble formation**. The existing body of research in this field, especially from a theoretical standpoint, is insufficiently developed and applied [ 35].

The following timeline summarizes the key saturation thresholds for the battery- storage market, illustrating its heightened risk of speculative overheating compared to solar and wind:

Particularly in technologically advanced sectors, the **results coincide with earlier research on financial market saturation and bubble dynamics**. Previous studies on financial Energies 2025, 18, 1400 16 of 20 bubbles imply that **when market expectations differ from basic values, speculative behavior gets more intense, which causes asset overvaluation and consequent corrections** [1 ,2 ]. **Driven by governmental** and environmental **aims, the renewable energy sector follows similar investment trends, whereby fast development can cause possible overheating** [3].

• **Battery storage is the most speculative sector**. The findings reflect earlier studies showing that **newer technologies with fast growth rates**—such as battery storage—**are more prone to financial speculation** [4 ,5]. **Early bifurcation of battery storage** (2031 in the medium term, 2042 in the long term) **and expected overheating** (~2048) **point to this industry being most vulnerable financially**.

• High investment volatility of **solar energy**. **Policy-driven incentives, including feed-in tariffs** (FiTs), **have helped overcome price rises and crashes** (e.g., Spain’s solar market collapse) **according to historical studies** of solar-energy investment cycles [ 6 ,9]. This work supports these results by determining 2030 (medium term) and 2039 (long term) as the crucial solar PV bifurcation point.

• Unlike solar and battery storage, **wind energy shows reduced saturation risks**, which corresponds with past research stressing **longer investment cycles and infrastructural restrictions as natural stabilizing forces** [10].

These comparisons show that **distinct investment and policy measures are needed for renewable energy financial risks since they are technologically specific**.

5.2. Policy and Investment Implications

5.2.1. Managing Speculative Risks in Renewable Energy Markets

**The existence of speculative investment cycles implies the necessity of government actions to stop market overheating**. Renewable energy markets may suffer asset price collapses without appropriate protections, much like prior financial bubbles in other sectors [11].

**Key policy recommendations include:**

**1. Gradual Phase-Out of Incentives**: • Governments should avoid abrupt subsidy removals, as seen in past crises (e.g., Spain’s FiT reduction in 2013) [6].

• Instead, **gradual reductions in incentives can help maintain investment stability while preventing speculative surges**.

**2. Stronger Financial Oversight:**

• **Regulatory bodies should** monitor financial saturation levels (~70% and ~90% thresholds) to **intervene if speculative risks increase**.

• **Financial stress tests** for high-growth renewable energy sectors **could prevent overleveraging and mitigate market crashes**.

**3. Diversification of Investment Models:**

• Encouraging **long-term infrastructure investments** (e.g., Power Purchase Agree- ments) **over short-term speculative capital flows would reduce financial instability**.

• Governments could support public–private partnerships that focus on sustainable financing.

5.2.2. Implications for Investors

The findings underline for investors the importance of risk-adjusted portfolio manage- ment in the markets for renewable energy:

• Battery-Storage Investment Risks: **Investors should carefully evaluate market val- ues and refrain from too strong short-term speculation** given the great chance of overheating in the battery sector by 2031 and 2038 in different periods.

• The **volatility of the solar business calls for hedging techniques like diversified portfolios balancing solar investments with more reliable energy sources**.

• Wind energy as a reduced-risk option: Because of its slower saturation trajectory and reduced speculative risks, investors looking for consistent, long-term returns might give wind energy top priority.

5.3. Long-Term Sustainability of Renewable Energy Markets

Beyond only financial concerns, the **possibility of speculative bubbles in markets for renewable energy has wider consequences for energy security and climate targets. A financial crisis in renewable energy could cause**:

**• Slowness in investments, postponing the energy changeover**.

**• Loss of public trust, so lowering political and financial backing for next initiatives**.

**• Market corrections, therefore raising the capital cost for sustainable energy.**

**• Energy markets should concentrate on sustainable, policy-driven investment strategies instead of speculative development patterns** if we are to guarantee long-term stability.

#### Bubbles cause collapse — China empirically proves. Wang 20

**Wang 20** [Wang, Kai-Hua, Chi-Wei Su, Oana-Ramona Lobonţ, and Nicoleta-Claudia Moldovan. “Chinese Renewable Energy Industries’ Boom and Recession: Evidence from Bubble Detection Procedure.” Energy Policy 138 (March 2020): 111200. https://doi.org/10.1016/j.enpol.2019.111200. Kai-Hua Wang is an associate professor in the School of Economics at Qingdao University, China. He has two years of research experience in an academic institution, and his research interests focus on energy economics, international finance and corporate finance. He presides over one Qingdao City Social Science Foundation Project and publishes more than ten papers in professional academic journals.] //arrguy

. The bubble behaviours would lead to over- or under-investment for these industries, influence investors’ confidence, and exacerbate renewable energy stock price volatility. It is worse than no one or some reasons can interpret explosive behaviours, hence the powerful method is needed. Third, the existing test of MS-ADF that employed in Bohl et al. (2013) has low powerful in detecting multiple bubbles (Phillips et al., 2011). Hence, this paper employs powerful SADF and GSADF tests to investigate bubble behaviours in Chinese renewable energy industry. Meanwhile, depending on new date-stamping strategy, this paper recognizes originating and finishing points of each bubble, which is expected to construct an early warning mechanism. The major contributions of our study to prior literature are shown as follows. **First, China confronts a serious dilemma that the unreasonable energy supply structure cannot support the booming energy demand.** In order to solve this problem, China puts considerable resources such as capital and technology to develop renewable energy industry. **Boom and recession are accompanied by industrial development process, which supplies a unique and typical example to analyze renewable energy industries.** Especially, being different from existing studies used the overall sample data, we identify and analyze different characters among solar, wind and hydro industries, which can provide more accurate conclusion. Second, effective warning mechanism for detecting bubbles ought to be provided for all kinds of market practitioners. Hence, the Supremum Augmented Dickey–Fuller (SADF) and the Generalized Supremum Augmented Dickey–Fuller (GSADF) tests are employed to investigate bubble behaviours in renewable energy industries. Both methods perform better than other bubble detecting approaches since they allow testing nonstationary process period by period, which is against mildly explosive alternatives (Phillips et al., 2013). **The GSADF test employs flexible window process to extend sample sequence, which further increases detecting accuracy, especially when confronting multiple bubbles (Su et al., 2017a).** Third, compared to previous methods, this study depends on recursive procedures and cross-time occurrence to recognize starting and ending time points in each bubble behaviours. That clearly offers dating algorithm anticipation and could construct early warning diagnostic system to assist supervisors in monitoring market actions. **We conclude that multiple bubble behaviours exist in renewable energy industries, which are influenced by stock market collapse, macroeconomic condition, government policy changes and high operation costs.** Meanwhile, industrial policies, technology, infrastructure may result in special bubbles in wind, solar and hydro industries. The paper provides an explanation based on the bubble model and pays attention to the formation of the bubble part. Combing with bubble evolution, we should adopt policies to promote renewable energy industry development. These are evidenced in followings: government should keep persistent implement of renewable energy policies, perfect electric infrastructure and guide reasonable investment for these industries. Firms should accelerate technique innovation, industrial development stage, concern macroeconomic condition changes, and foreign competition. This paper is shown as follows: Section 2 illustrates Methodology. Sections 3 presents Data. Sections 4 shows empirical results. Section 5 draws conclusions and infer policy implications.

#### That’s devastating. In 2008, Boston University quantifies

**BU-13** (Boston University, 11-1-2013, “The Financial Crisis and The Great Recession,” BU. https://www.bu.edu/eci/files/2019/06/MAC\_2e\_Chapter\_15.pdf //everyone and their mother)

**The crisis** also **spread** **beyond U.S. borders.** As **consumption** and **income declined** **in** the **United States, many countries experienced** a **significant reduction in exports** as well as a **decline in the investments** that they **held in the United States**. As a result, global GDP declined by 2 percent in 2009. It has been estimated that between 50 million and **100 million people around the world** either **fell into,** or were prevented from escaping, **extreme poverty due** **to** the **crisis**. Why did this happen? Why were its effects so long-lasting? What lessons can be learned for the future? These are complicated questions to which this chapter provides some answers.The **economic** **impact** of the **financial crisis persisted for** an **unusually long** **period**. The **unemployment rate remained above 7 percent through late 2013** (see Box 15.1). Why was this? As we saw in earlier chapters, the circular flow economy can, in difficult times, producea vicious cycle. Unemployed workers generally have less income to spend. Families facing income losses and needing financial assistance can ordinarily borrow money—but after thefinancial crisis of 2007–8, banks and financial institutions introduced tougher standardsfor credit card loans and. home equity loans, in which an equity stake in a home is posted s collateral. This led to a “credit crunch” in which families and business were unable to obtain loans. Many families were therefore compelled to cut their spending further; in the period from 2008 to 2011, U.S. consumers on average reported spending $175 per month less than they would have in the absence of a recession. Many employers, suddenly facing lower profits, fired workers, contributing to a vicious unemployment cycle. While the values of MBSs and other newfangled securities seemed to plunge overnight, it took much longer for the ensuing credit contraction to affect business bottom lines, employment decisions, and consumer spending. Thus the crisis that began in 2007 led to a recession and **very slow recovery** that **lasted more than five years**.

## Contention 2: Environment

#### Renewable energy is rapidly advancing and can address 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, DOA 3-25-2025 //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.¶ 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.

**Indeed - Weiss 25** (Tim Weiss, Co-Founder & CEO of Optera. “What 2025 Means for the Climate Crisis and Businesses”, 1/17/25, SDC, <https://www.sdcexec.com/sustainability/carbon-footprint/article/22930386/optera-what-2025-means-for-the-climate-crisis-and-businesses> DOA 3/17/25)SRT

As a result, **investors, consumers, regulators and markets are paying closer attention to companies’ climate initiatives** than ever before. In the last few years, the U.S. government has introduced some initiatives to address climate change. However, the Trump administration is unlikely to accelerate emissions reduction activities through regulatory action. The president supports increased production of fossil fuels, rather than investing in new, forward-looking clean energy technologies. Because these technologies have not yet achieved economies of scale, a lack of federal investment will hamper their growth and adoption. The government’s opposition to ESG and sustainability initiatives may also curtail regulations like the SEC’s climate disclosure rules. Without federal guidance, the **private sector must take the lead** on decarbonization initiatives. Market Demand for a Low-Carbon Economy **Companies have a lot to gain from transitioning** to a low-carbon economy. Consumers and **investors demand this change**, **even if** the **federal government does not continue** actively incentivizing the transition. Investor pressure for supply chain sustainability has surged 25% in five years. Another study found that sustainability is one of the top three purchasing criteria for corporate buyers, and 75% of consumers believe practicing a sustainable lifestyle is important. U.S. survey respondents said they would pay 10% more for environmentally friendly products. **Renewable energy makes business sense,** too. These **sources are cheaper and less subject to dramatic price swings** than fossil fuels, **while also reducing transition risks** in the supply chain. Bloomberg projects that **market dynamics** alone **will drive renewables to account for 50% of energy production in the next five years**. Taking no action will be costly to the planet and the bottom line. McKinsey estimates that failure to reduce emissions could put 20% of a company’s profits at risk by 2030 because of the increased push toward sustainability. Companies are taking action toward this goal.

**Affirming derails progress, every dollar spent on nuclear is a dollar taken away from renewables**

**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/, DOA 3-25-2025 //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 CO2 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 CO2 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 grid can’t handle both types of energy

**CANE 24 finds** “POSITION PAPER: The nuclear hurdle to a renewable future and fossil fuel phase-out.” CAN Europe. March 18, 2024. [https://caneurope.org/position-paper-nuclearenergy/.](https://caneurope.org/position-paper-nuclear-energy/) Accessed March 8, 2025.

**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.

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#### This has historically happened in a lot of places

Harvey **Wasserman**, Progressive.org, 04-22-20**23** // // Earth Day 2023: A Newly Post-Nuclear Germany vs. California’s Reactor Relapse // https://progressive.org/latest/earth-day-2023-germany-vs-california-wasserman-04222023/ // accessed 3-28-2025 // ashe

On April 15, **Germany** claimed a huge global landmark by becoming one of the world’s wealthiest nations to pull the plug on atomic power. The decision dates back to 2011, when Germany’s powerful Green movement led a national demonstration aiming to **shut** the **seventeen atomic reactors** that, at the time, provided around a quarter of the nation’s electricity. Before the rally took place, four reactors blew up in Fukushima, Japan, sending huge clouds of radioactive fallout into the air and ocean. Germany’s then-Chancellor Angela Merkel—who has a Ph.D. in quantum chemistry—ordered eight reactors immediately shut, and soon announced a plan to shut the remaining nine by December 31, 2022. This energiewende, or “energy transition,” substitutes wind, solar, battery storage, and increased efficiency for nuclear power reactors, **moving Germany toward full reliance on renewables**. Germany, **since then [Germany]**, **has invested billions** **in the renewables sector**, transitioning whole towns to locally owned, rooftop solar power and corporate wind power pumped in from large turbines in the North Sea. The shutdown of the final three reactors was delayed by nearly four months due to natural gas shortages caused by the Russian war in Ukraine. It was also complicated by a major atomic breakdown **in** neighboring **France**. **Heavily reliant on nuclear power**, France’s **more than fifty** standard-design **reactors succumbed to** a wide range of **problems**, **including** generic **structural flaws and warming rivers** too hot to cool their super-heated radioactive cores. In 2022, with more than half its fleet of reactors under repair, France made up for the energy shortfall by importing power from Germany, much of it fired by the burning of coal. This prompted the nuclear industry to criticize Germany’s plan by pointing to a rise in the country’s CO2 emissions from burning increased quantities of coal, failing to note that much of that power was being exported to France to compensate for its own shuttered reactors. **California**, **whose** economy may now be slightly larger than Germany’s, has taken an opposite route. Two of its **last four reactors**—at San Onofre, between Los Angeles and San Diego—**were shuttered** in 2012 and closed permanently **in 2013** after flaws were found in the turbines and other components. In 2016, a deal was reached to shut the Golden State’s last two reactors, located at Diablo Canyon, nine miles west of San Luis Obispo. In the 1970s and 1980s, thousands of protestors were arrested at Diablo Canyon, more than at any other American nuclear plant. The 2016 shutdown deal involved another energiewende, based on blueprints to replace Diablo’s power with a huge influx of new wind, solar, battery, and efficiency installations. The agreement was approved by the California state legislature, Pacific Gas & Electric (PG&E), the federal Nuclear Regulatory Commission (NRC) and the state Public Utilities Commission. It was signed by then-Governor Jerry Brown, then-Lieutenant-Governor Gavin Newsom, and a wide range of local governments, unions, and environmental groups, all of whom assumed the state would thus be nuke-free once Unit Two was shut in 2025—the date its original forty-year license would expire. But **along the way, the state experienced two** close calls with **partial blackouts**. During both incidents, Newsom, now the governor, asked consumers to dial back their energy use. Ironically, independent battery capacity—mostly controlled by individual owners—helped the state stay lit.

#### That’s terrible, renewables are preferable to nuclear

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#### In terms of climate,

“Two’s a crowd: Nuclear and renewables don’t mix.” **ScienceDaily**, October 5, 20**20**, https://www.sciencedaily.com/releases/2020/10/201005112141.htm. Accessed March 9, 2025.

If countries want to lower emissions as substantially, rapidly and cost-effectively as possible, they should prioritize support for renewables, rather than nuclear power. That's the finding of **new analysis of 123 countries over 25 years** by the University of Sussex Business School and the ISM International School of Management which **reveals**

that **nuclear energy** programmes around the world **tend not to deliver sufficient carbon emission reductions** and so should not be considered an effective low carbon energy source. Researchers found that **unlike renewables[.]**,countries around the world with larger scale national nuclear attachments do not tend to show significantly lower carbon emissions -- and in poorer countries **nuclear** **programmes** actually tend to **associate with** relatively **higher emissions.**

#### In contrast,

**Khan**, Anwar et. al. “Efficacy of CO2 emission reduction strategies by countries pursuing energy efficiency, nuclear power, and renewable electricity.” Energy, August 1, 20**24**, https://doi.org/10.1016/j.energy.2024.131418. Accessed March 9, 2025.

As such, this research proposes hierarchical analyses using stepwise regression and pairwise correlation **for 133 countries over 31 years** to explain how they use their energy sources, including efficiency, nuclear, and renewable electricity pathways, to mitigate CO2 emissions. Firstly, the results discover that **renewable electricity effectively mitigates CO2 emissions**, further supported by the incremental change in the R-squared value. Secondly, the results do not support the idea that nuclear power mitigates CO2. In contrast, it is noted that the efficacy of nuclear power on CO2 emission mitigation is effective through the moderation of GDP..

**Reducing climate change is key, every degree matters.**

**Cassella 23 For every 0.1 °C degree of warming from now on, the world could suffer roughly 100 million deaths**. "If you take the scientific consensus of the 1,000-ton rule seriously, and run the numbers, anthropogenic global warming equates to a**billion premature dead bodies over the next century**," explains energy specialist Joshua Pierce from the University of Western Ontario in Canada. "Obviously, we have to act. And we have to act fast." The human death rate from climate change is extremely tricky to calculate, even in the present day. The United Nations reports that every year, environmental factors take the lives of about 13 million people, and yet it's not clear how many of these deaths are directly or indirectly due to climate change. Some experts argue abnormal temperatures on their own may already claim as many as five million lives a year. Other estimates are much lower. Part of the problem is that the global effects of climate change are manifold. Crop failures, droughts, flooding, extreme weather, wildfires, and rising seas can all impact human lives in subtle and complex ways. Predicting the future death toll of these climate catastrophes is inherently imperfect work, but Pierce and his coauthor, Richard Parncutt from the University of Graz in Austria, think it's worth pursuing. They argue measuring emissions in terms of human lives makes the numbers easier for the public to digest, while also underlining how unacceptable our current inaction is.

# 2nc

#### It’s over already. Fornell 24

The **nuclear imaging isotope shorta**ge of molybdenum-99 (Mo-99) that was predicted to paralyze cardiac nuclear imaging may **be over much sooner than expected**. An update from the Nuclear Medicine Europe Emergency Response Team said its high-flux reactor (HFR) in the Netherlands has **successfully restarted** and the group anticipates that the **normal** global **supply** of Mo-99 will be **achieved later this week**.

#### Workarounds exist. [Fornell 24](https://cardiovascularbusiness.com/topics/cardiac-imaging/nuclear-cardiology/global-shortage-nuclear-imaging-isotopes-may-be-over#:~:text=Cardiac%20SPECT%20perfusion%20exam%20using,of%20cardiac%20perfusion%20imaging%20exams.) explains

"**To mitigate** the **shortages**, a couple of the **centers** I spoke with **ended up** trying to **change patients** over **to PET**, which was really successful for a good number of groups. And we're seeing that, because there's definitely an uptick that's occurring in cardiac PET and that's allowed a good ability to mitigate some of the issues over the last couple of weeks," Phillips said. Since most nuclear cardiology imaging studies are still SPECT, additional measures were needed to mitigate the short supply. "Unfortunately, there was some rescheduling of patients, sometimes last minute, but really we are trying to get the patients back in as quick as possible," Philips explained. He said many **centers also conserve supplies** by using a lower dose with longer imaging times. Phillips said this allowed centers, **especially high volume locations**, to stretch things further. This strategy was successful in allowing centers to not have to decrease the number of doses they could use by just changing the workflow. Phillips also heard of some centers that are doing stress first SPECT imaging. This enabled centers the ability to do stress only exams and not need rest imaging by determining if the patient had any high-risk features on their perfusion scan. This also helped lower the amount of technetium needed. If the supply of technetium was unavailable, some centers also sent patients for CT scans in some cases as an alternative.

**Isotopes don’t have to be made in reactors; other manufacturing processes exist.**

Wang, Yiwei, et al. “Production Review of Accelerator-Based Medical Isotopes.” Molecules, August 19, 2022, https://pmc.ncbi.nlm.nih.gov/articles/PMC9415084/. Accessed March 11, 2025.

Presently, **cyclotrons** remain the primary facilities for accelerator-based medical isotope production, although linacs and neutron generators are rapidly becoming a viable alternative. Cyclotrons with adjustable energy ranges or medium energy can produce various kinds of medical isotopes and can cover most radiopharmaceutical production needs in a region [59]. Yield and purity improvements in medical isotopes and the overall cost of cyclotron production have led researchers to explore further possibilities, including proton linacs, which have significant advantages in providing proton beams in the order of tens to hundreds of MeV [179]. These **linacs** can be developed in research institutes or laboratories conducting scientific experiments and physical research at the same time. For electron linacs, the cross-section of photonuclear interactions is relatively low, which restricts their practical applications. Other factors, such as impurity products and economic costs, also play major roles when evaluating production techniques and methodologies. Attempts to produce medical isotopes through **neutron generators** are promising and could theoretically yield the medical isotopes that are currently produced by reactors. However, improving the neutron flux rate remains a major consideration. **As medical isotopes produced by reactors often face supply shortages, interest in the use of accelerator-based techniques** to produce medical isotopes will increase.

**Domestic suppliers are ramping up production of medical isotopes in the status quo according Orland 24**

# On c2

**REgs down now - upgrades can’t solve**

**And regulations are going down**

**Macfarlane 25** [Allison Macfarlane, Professor and director of the School of Public Policy and Global Affairs at the University of British Columbia, 2-21-2025, 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/, GZR]

**President Trump, through** his recent Executive Order, has **attacked independent regulatory agencies in the US government**. This order gives the Office of Management and Budget power over the regulatory process of until-now independent agencies. **These regulatory agencies include the Federal Elections Commission, the Federal Trade Commission, the Securities and Exchange Commission, the Federal Energy Regulatory Commission**—and my former agency, the Nuclear Regulatory Commission, which I chaired between July 2012 and December 2014.

**An independent regulator is free from industry and political influence**. **Trump’s executive order flies in the face of this basic principle by requiring the Office of Management and Budget to** “**review**” **these independent regulatory agencies’ obligations** “for consistency with the President’s policies and priorities.” **This essentially means subordinating regulators to the president**.

In the past, the president and Congress, which has oversight capacity on the regulators, stayed at arm’s length from the regulators’ decisions. This was meant to keep them isolated, ensuring their necessary independence from any outside interference. Trump’s executive order implies there are no longer independent regulators in the United States.

Independent regulators should not only be free from government and industry meddling; they also need to be adequately staffed with competent experts and have the budget to operate efficiently. They also need to be able to shut down facilities such as nuclear power plants that are not operating safely, according to regulations. To do this, they need government to support their independent decisions and rulemaking.

**Independence matters**. When I was chairman, I traveled the world talking about the importance of an independent regulator to countries where nuclear regulators exhibited a lack of independence and were subject to excessive industry and political influence. It is ironic that the US Nuclear Regulatory Commission—often called the “Gold Standard” in nuclear regulation—has now been captured by the Trump administration and lost its independence. So much for the Gold Standard; the Canadian, the French, or the Finnish nuclear regulator will have to take on that mantle now.

**To understand what is at stake, one needs to look no further than the Fukushima accident** in March 2011, **which showed the world how a country’s economic security is vulnerable to a captured regulator**. After a magnitude 9.0 earthquake followed by a massive tsunami, the Fukushima Daiichi nuclear power plant, with its six reactors on Japan’s east coast, lost offsite power. The tsunami flooded their backup diesel generators, and the plant fell into the station blackout, leading to the complete loss of all power on site.

With no power to operate pumps to get cooling water into the reactors’ cores or into spent fuel storage pools, three reactor cores melted down—the first within hours of loss of power—with a concomitant release of large amounts of radionuclides due to containment breaches from hydrogen explosions.

Firefighters desperately tried to get water into the spent fuel pool of Unit 4 to ensure that pool water did not boil off since the pumps were no longer working. Should the spent fuel rods have become uncovered and no longer cooled, the fuel’s temperature would rapidly increase, and the fuel rods would melt, causing the release of even larger amounts of radiation material into the atmosphere threatening the Tokyo metropolitan area. Fortunately, the emergency workers got water to the pool within a few days of the fuel being uncovered.

Nonetheless, 160,000 people evacuated from the area near the reactors and along the corridor of radiation contamination to the northwest of the Fukushima Daiichi plant. Overnight, the agricultural and fishing industries near Fukushima were devastated. **Within a year after the accident, all 54 reactors in Japan were shut down**—**a loss of about a third of the country’s electricity supply**. More expensive diesel plants had to be set up to compensate for some of the missing power. The direct economic costs of the accident were estimated to be on the order of $200 billion—and even that number excluded the costs of replacing the lost power and multiple reactor shutdowns due to the reassessment of seismic hazards. **Nearly 14 years later, only 13 nuclear reactors have been turned back on, and 21 have been permanently shut down**. (The other 20 reactors are waiting for regulatory and prefecture approval.)

An independent investigation by the Diet (Japan’s house of parliament) into the cause of the Fukushima accident concluded unequivocally that: “**The TEPCO Fukushima Nuclear Power Plant accident was the result of collusion between the government, the regulators and TEPCO, and the lack of governance by said parties**. They effectively betrayed the nation’s right to be safe from nuclear accidents.” Japan’s government and nuclear industry continue to struggle with the clean-up of the Fukushima site, and it purposely began in 2023 to release still-contaminated water into the Pacific Ocean. Nearby countries responded by banning fishing products from the region.

As the industry often says, **a nuclear accident anywhere is a nuclear accident everywhere**. After the Fukushima accident, the US nuclear industry spent over $47 billion in safety upgrades to respond to lessons learned from the Fukushima accident. **These included the realization that not only more than one reactor could fail at a single power plant**, but also that backup generators needed to be in safe locations, not subject to flooding and other forms of failure; that generic fittings for pumps and equipment were needed so that any nearby equipment could be connected during an accident; that containments should be able to be vented remotely; that natural events such as earthquakes and flooding could be underestimated in the original reactor designs; and that spent fuel pools needed to provide real-time data in accident conditions. The upgrades that resulted from these lessons have greatly increased the safety of reactors in the United States and elsewhere. They were required because each of these upgrades was deemed necessary to address the lessons learned by the independent regulator. On its own, the industry might not have undertaken any of these measures.

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 agency will no longer be able to fully follow through with this mission independently**—and Americans will be more at risk as a result. **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?

**Even with accidents nuclear power is still safe**

Paul **Fanto**, 2-7-20**19**, "A Green Nuclear Deal:Why The U.S. Should Expand Nuclear Power", Distilled Periodical, <https://yaledistilled.sites.yale.edu/browse-issues/2019-issue/green-nuclear-dealwhy-us-should-expand-nuclear-power>

However, all available evidence shows that these standards are met, both in the U.S. and globally. According to data compiled by the earth scientist James Conca in 2012, **the number of deaths per trillion-kW hour of electricity produced globally by nuclear power was 90, including estimates for Chernobyl and Fukushima, compared with 150 for wind power and nearly 4,000 from natural gas** (23). While these numbers rely on epidemiological assumptions, the main point is that **the nuclear reactors currently in operation are relatively very safe.** **Even in the case of serious accidents, modern reactors are safer than is currently believed. According to the World Health Organization, no significant health effects from radiation released at the Fukushima nuclear plant have been documented, even among those with the most radiation exposure** (24). Finally, advanced reactor designs currently under construction, such as the Westinghouse AP1000 reactor, involve passive safety features—safety mechanisms that do not have to be actively triggered (25). A recent study by the Massachusetts Institute of Technology (MIT) Energy Initiative entitled The Future of Nuclear Energy in a Carbon-Constrained World found that these mechanisms are already commercially viable in plants in operation in China, Russia, and the U.S. (26).

**Past precedent shows that accidents are very rare, and we learn from our mistakes**

**Kleinman Center for Energy Policy**, 8-1-20**19**, "Could Chernobyl Happen Today?", <https://kleinmanenergy.upenn.edu/commentary/blog/could-chernobyl-happen-today/>

After watching the program, I pulled out my computer and was distressed to find that Philadelphia is in a [50-mile fallout zone](https://www.smithsonianmag.com/science-nature/do-you-live-within-50-miles-nuclear-power-plant-180950072/). If there were to be similar disaster event at the Limerick power plant, we would be impacted. According to the [Natural Center for Disaster Preparedness at Columbia University](https://ncdp.columbia.edu/library/mapsmapping-projects/nuclear-power-plants-earthquake-risk/), over one third of Americans live within 50 miles of a nuclear power plant. Of the country’s 20 most highly populated metro areas, at least part of 14 of them are within 50 miles of a nuclear plant.

But how much is there a cause for concern? How likely is it that another cataclysmic event could occur? Data shows that nuclear power plant accidents are [low and declining](https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.aspx) and the consequences of an accident are minimal compared with other commonly accepted risks.

[Harold Feiveson](https://www.tandfonline.com/doi/full/10.1080/00963402.2016.1145910), a nuclear expert at Princeton University, wrote that, assuming the chance of a severe accident were one in a million per reactor year, a future nuclear capacity of 1,000 reactors worldwide would be faced with a 1 percent chance of such an accident each 10-year period. He calls this risk “low but not negligible.”

Additionally, the [World Nuclear Association points out](https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.aspx) that **there have only been three major accidents** (Chernobyl, Fukushima, and Three Mile Island) **that have occurred in over 17,000 cumulative reactor-years of commercial nuclear power operation in 33 countries.** Not a bad track record.

And the world has certainly learned from past mistakes. **There are** [**no reactors like the one used**](https://www.businessinsider.com/chernobyl-meltdown-no-graphite-us-nuclear-reactors-2016-4) **in Chernobyl (RBMK) operational in the United States. Human operators have learned from the errors made decades ago. Following Fukushima, the** [**Nuclear Regulatory Commission**](https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/japan-events.html)released recommendations and **asked all nuclear facilities to submit plans for flooding and earthquake preparedness. So if the same scenario occurs again, all nuclear plants are better equipped to manage the problem.**

While there is some risk, there is also an important benefit. With today’s available technologies, nuclear plays a key role in a decarbonized future. As we turn away from fossil fuels and towards cleaner sources of energy, nuclear can have a large role as a huge source of clean power. Does the risk posed by catastrophic climate change outweigh the underling risk of a nuclear disaster? Many would [say yes](https://www.nytimes.com/2019/04/06/opinion/sunday/climate-change-nuclear-power.html).

Not to mention the benefit when compared to dirtier fuel sources. Living near a coal fired power plant [can lead to](https://phys.org/news/2018-09-health-effects-coal-burning-power-unknown.html), “higher death rates and at earlier ages, along with increased risks of respiratory disease, lung cancer, cardiovascular disease and other health problems.” While it doesn’t have the dramatic effect of a nuclear disaster event, living by dirty fossil fuels is a risk that millions endure every day.

Nuclear, like many technologies, cannot be 100% safe. There will always be some risk. But it is important to not let the risks outweigh the benefits.

## Nuclear Accidents are far less disastrous than other energy accidents - Rhodes 18

<https://e360.yale.edu/features/why-nuclear-power-must-be-part-of-the-energy-solution-environmentalists-climate>

Studies indicate **even the worst possible accident at a nuclear plant is less destructive than other major industrial accidents.** The partial meltdown of the Three-Mile Island reactor in March 1979, while a disaster for the owners of the Pennsylvania plant, released only a minimal quantity of radiation to the surrounding population. According to the U.S. Nuclear Regulatory Commission: “The approximately 2 million people around TMI-2 during the accident are estimated to have received an average radiation dose of only about 1 millirem above the usual background dose. To put this into context, exposure from a chest X-ray is about 6 millirem and the area’s natural radioactive background dose is about 100-125 millirem per year… In spite of serious damage to the reactor, the actual release had negligible effects on the physical health of individuals or the environment.” The explosion and subsequent burnout of a large graphite-moderated, water-cooled reactor at Chernobyl in 1986 was easily the worst nuclear accident in history. Twenty-nine disaster relief workers died of acute radiation exposure in the immediate aftermath of the accident. In the subsequent three decades, UNSCEAR — the United Nations Scientific Committee on the Effects of Atomic Radiation, composed of senior scientists from 27 member states — has observed and reported at regular intervals on the health effects of the Chernobyl accident. It has identified no long-term health consequences to populations exposed to Chernobyl fallout except for thyroid cancers in residents of Belarus, Ukraine and western Russia who were children or adolescents at the time of the accident, who drank milk contaminated with 131iodine, and who were not evacuated. By 2008, UNSCEAR had attributed some 6,500 excess cases of thyroid cancer in the Chernobyl region to the accident, with 15 deaths. The occurrence of these cancers increased dramatically from 1991 to 1995, which researchers attributed mostly to radiation exposure. No increase occurred in adults. “The average effective doses” of radiation from Chernobyl, UNSCEAR also concluded, “due to both external and internal exposures, received by members of the general public during 1986-2005 [were] about 30 mSv for the evacuees, 1 mSv for the residents of the former Soviet Union, and 0.3 mSv for the populations of the rest of Europe.” A sievert is a measure of radiation exposure, a millisievert is one-one-thousandth of a sievert. A full-body CT scan delivers about 10-30 mSv. A U.S. resident receives an average background radiation dose, exclusive of radon, of about 1 mSv per year. The statistics of Chernobyl irradiations cited here are so low that they must seem intentionally minimized to those who followed the extensive media coverage of the accident and its aftermath. Yet they are the peer-reviewed products of extensive investigation by an international scientific agency of the United Nations. They indicate that even the worst possible accident at a nuclear power plant — the complete meltdown and burnup of its radioactive fuel — was yet far less destructive than other major industrial accidents across the past century. **To name only two: Bhopal, in India, where at least 3,800 people died immediately and many thousands more were sickened when** 40 tons of methyl isocyanate **gas leaked from a pesticide plant; and Henan Province, in China, where at least 26,000 people drowned following the failure of a major hydroelectric dam** in a typhoon. “Measured as early deaths per electricity units produced by the Chernobyl facility (9 years of operation, total electricity production of 36 GWe-years, 31 early deaths) yields 0.86 death/GWe-year),” concludes Zbigniew Jaworowski, a physician and former UNSCEAR chairman active during the Chernobyl accident. “This rate is lower than the average fatalities from [accidents involving] a majority of other energy sources. For example, **the Chernobyl rate is nine times lower than the death rate from liquefied gas… and 47 times lower than from hydroelectric stations.**”