# Topic

Resolved: The United States federal government should substantially increase its investment in domestic nuclear energy.

PF Topic Overview

In the last few years, the U.S. has seen a resurgence of interest in nuclear energy and its potential for helping meet the nation’s growing demands for clean electricity and energy security. Meanwhile, nuclear energy technologies themselves have advanced, opening new possibilities for their use.

Questions have been raised by the cost and length of projects in the US such as the Vogtle Electric Generating Plant in Georgia. The safety and reliance of these projects has also been questioned by accidents such as the Three Mile Island in 1979. Demonstrating a need to question and investigate if nuclear power is the best solution for the needs of those in the United States.

According to the US Energy Information Administration, as of July 2024, there are 94 active commercial nuclear reactors at 54 nuclear power plants.

Additional Resources:

<https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power>

<https://www.nationalacademies.org/news/2025/02/exploring-the-new-nuclear-energy-landscape#:~:text=In%20the%20last%20few%20years,new%20possibilities%20for%20their%20use>.

# Affirmative

Resolved: The United States federal government should substantially increase its investment in domestic nuclear energy.

*Definitions*

Investment: the outlay of money usually for income or profit:capital outlay. (Merriam Webster, https://www.merriam-webster.com/dictionary/investment)

Domestic: of, relating to, or originating within a country. (Merriam Webster, https://www.merriam-webster.com/dictionary/domestic)

Nuclear energy: Nuclear energy is the energy in the nucleus, or core, of an atom. Nuclear energy can be used to create electricity, but it must first be released from the atom. In the process of nuclear fission, atoms are split to release that energy. A nuclear reactor, or power plant, is a series of machines that can control nuclear fission to produce electricity. (National Geographic, https://education.nationalgeographic.org/resource/nuclear-energy/)

**Framework**

**Cost-benefit analysis**

The framing for today’s round ought to be cost benefit analysis. If we demonstrate that the United States substantially increasing investing in domestic nuclear energy provides more good than harm, we should win the round.

## Contention 1: Clean Energy

#### Nuclear energy is clean energy

US Department of Energy 2024

The Office of Nuclear Energy, part of the US Department of Energy. They are an applied energy research and development organization whose mission is to advance nuclear energy science and technology to meet U.S. energy, environmental, and economic needs. “Advantages and Challenges of Nuclear Energy”. Published in the Department of Energy Website. June 11, 2024. Available here: (<https://www.energy.gov/ne/articles/advantages-and-challenges-nuclear-energy#:~:text=Nuclear%20energy%20protects%20air%20quality,medical%20field%20to%20space%20exploration>.) - JB

1. **Nuclear energy protects air quality. Nuclear is a zero-emission clean energy source**. It generates power through fission, which is the process of splitting uranium atoms to produce energy. The heat released by fission is used to create steam that spins a turbine to generate electricity without the harmful byproducts emitted by fossil fuels. **According to the Nuclear Energy Institute (NEI), the United States avoided more than 471 million metric tons of carbon dioxide emissions in 2020. That’s the equivalent of removing 100 million cars from the road and more than all other clean energy sources combined. It also keeps the air clean by removing thousands of tons of harmful air pollutants each year that contribute to acid rain, smog, lung cancer and cardiovascular disease.**

2. **Nuclear energy’s land footprint is small**. Despite producing massive amounts of carbon-free power, **nuclear energy produces more electricity on less land than any other clean-air source**. A typical 1,000-megawatt nuclear facility in the United States needs a little more than 1 square mile to operate. **NEI says wind farms require 360 times more land area to produce the same amount of electricity and solar photovoltaic plants require 75 times more space**. To put that in perspective**, you would need more than 3 million solar panels to produce the same amount of power as a typical commercial reactor or more than 430 wind turbines** (capacity factor not included).

3. **Nuclear energy produces minimal waste. Nuclear fuel is extremely dense**. It’s about 1 million times greater than that of other traditional energy sources and because of this, the amount of used nuclear fuel is not as big as you might think. **All the used nuclear fuel produced by the U.S. nuclear energy industry over the last 60 years could fit on a football field at a depth of less than 10 yards!**

#### Nuclear is lower in emissions compared to other energy sources

**Laffan 2024**

Laffan, Katy. Multimedia Producer at the International Atomic Energy Agency Office of Public Information and Communication (IAEA). International Day of Cleanup. January 25, 2024. Published by International Atomic Energy Agency (IAEA). Available here: (<https://www.iaea.org/newscenter/news/international-day-of-clean-energy-why-nuclear->

power) - JB

**Only two forms of clean energy can currently provide the scale of power needed to keep electricity flowing 24/7, while the world transitions away from fossil fuels. Both hydropower and nuclear power** offer the non-stop baseload power required for sustainable economic growth and improved human welfare. **Nuclear energy already provides around a quarter of the world’s low-carbon electricity. It offers large amount of reliable, dispatchable power providing stability and resilience to the electrical grid and backing up variable renewables such as solar and wind when sunshine or wind are lacking. According to a 2022 report from the International Energy Agency (IEA): “Nuclear energy can help make the energy sector's journey away from unabated fossil fuels faster and more secure.”**  Wind and solar are expected to lead the push to replace fossil fuels. But IEA experts advise that electricity grids also need more stable, resilient and dispatchable power to keep the flow of energy going non-stop. This cannot currently be provided by renewables alone**. Gas has been providing this stability, but it still emits greenhouse gases. Aside from its low carbon credentials, nuclear power has other features that further support energy supply security and the clean energy transition. For example, one large nuclear power plant can replace multiple coal-fired power plants to provide the same level of energy. Or small modular reactors could be slotted in to replace the old coal-fired plants of similar size,** on the same site. Energy-intensive industries, such as steel production, which use coal for heating and hydrogen production, could also be decarbonized using nuclear power, thanks to the ability of advanced reactors to produce high temperature steam. **Nuclear electricity production costs are less sensitive to changes in fuel prices than electricity from oil and gas.** Uranium is available from a range of diverse producer countries, and is incredibly energy dense, meaning comparatively low volumes are required. Enough uranium fuel for several years of electricity production can also be easily stored on the site of nuclear power plants. **When compared with other sources of electricity from cradle to grave, nuclear energy has the lowest carbon footprint, uses fewer materials and takes up less land. For example, solar power needs more than 17 times as much material and 46 times as much land to produce one unit of energy.**

## Contention 2: Jobs

#### The Nuclear Industry Creates Jobs

Nuclear Energy Institute 2024

Nuclear Energy Institute, leading U.S. policy and technical organization dedicated to all aspects of the commercial nuclear industry. “Jobs. A single nuclear power plant creates more jobs than any other type of energy generation facility.” Last updated 2024. Last accessed 4/7/2025, Available here: (<https://www.nei.org/advantages/jobs#:~:text=Each%20nuclear%20power%20plant%20employs,9%2C000%20workers%20at%20peak%20construction>.) - JB

**The nuclear energy industry is a powerful engine for job creation. The U.S. nuclear energy sector directly employs more than 70,000 people in high-quality, long-term jobs.** **This number climbs to 250,000 when you include secondary jobs**. We cannot afford to lose nuclear jobs by closing plants, nor can we afford to miss out on thousands of jobs that building new reactors will create. Each nuclear power plant employs 500 to 800 workers. Nuclear power plants can operate out to 80 years or more, so a nuclear power plant can provide jobs for multiple generations of workers**. Building a nuclear power reactor employs up to 9,000 workers at peak construction. Nuclear workers’ salaries are 50 percent higher on average than those of other electricity generation sources.** The U.S. nuclear industry spends roughly $11B annually on labor, which is approximately $100M per reactor per year. **For every 100 nuclear power plant jobs, 250 additional jobs are created in the U.S.** Nearly one in four nuclear workers are veterans. **The nuclear energy industry creates lasting, high-paying jobs for people from a wide range of fields and educational backgrounds. Recruiting from universities, community colleges, the military and trades, nuclear power plants provide high-quality jobs to the whole community**. Strong Growth Projections for Nuclear Industry Jobs**. The global demand for nuclear energy is rising rapidly and a new, next generation of reactors is on the horizon. Domestic job demand will skyrocket if the U.S. can maintain its nuclear technology leadership in the global marketplace.**

#### Nuclear workforce can be filled in quickly and is diverse

Steven 2021

Nesbit, Steven. President of the American Nuclear Society. Stephenson, Lonnie. International president of the International Brotherhood of Electrical Workers. “Nuclear energy ensures clean energy jobs for American workers”. Published in the Nuclear Newswire of the American Nuclear Society. September 8, 2011. Available here: (<https://www.ans.org/news/article-3228/nuclear-energy-ensures-clean-energy-jobs-for-american-workers/>) – JB

Above all, **nuclear energy is a job-creating powerhouse**. **A typical nuclear plant provides a livelihood for more than 1,000 employees and contractors**. The nuclear energy industry employs more workers per megawatt of electricity than any other energy source. Among all energy sources, nuclear power plants also have the highest labor union membership rates. The redevelopment of fossil fuel plants into nuclear plants would tap into the power industry’s existing networks and supply chains to recruit, train, and provide a qualified workforce for nuclear projects. **In a decarbonizing economy, nuclear energy offers a new career path for the U.S. electric power generation sector’s 210,000 fossil fuel workers**. **Fossil fuel plants, electrical engineers and plant operators can be quickly trained to work at a nuclear power plant**. This retraining will meet an immediate need by helping the U.S. nuclear energy industry replace 27,000 retiring employees over the next few years. **Employment in the nuclear energy industry means higher earnings, decades-long job security, and a pathway to the middle class.** **Workers at U.S. nuclear power plants receive the highest median wage within the power sector at $47 an hour,** according to research by Obama-era energy secretary Ernest Moniz’s Energy Futures Initiative. **A college degree is not required for these high-paying nuclear energy jobs.** **While** nuclear and electrical **engineers require a bachelor’s degree**, **many of the other jobs at a nuclear power plant, including reactor operators, technicians, supervisors, mechanics, and security officers, require no more than a high school diploma.** **The U.S. nuclear energy workforce is also one of the most diverse, with women constituting 36 percent of its workforce and employees from a racial minority background representing 34 percent, compared to a national industry average of 22 percent.** This is great progress, but more can be done.

## Contention 3: National Security

#### China and Russia lead the nuclear market

**Bowen 2020**

Dr. Bowen, Matt is a Senior Research Scholar at the Center on Global Energy Policy at Columbia University SIPA, focusing on nuclear energy, waste, and nonproliferation. Published by Center on Global Energy Policy at Columbia. September 29, 2020. Available here: (<https://www.energypolicy.columbia.edu/publications/why-united-states-should-remain-engaged-nuclear-power-geopolitical-and-national-security/>) - JB

**Rising Competition from China and Russia**. As mentioned, **the US domestic nuclear energy industry is facing substantial challenges in the US electricity sector**. US reactor vendors are also having difficulty competing with other supplier nations to be the vendor of choice for nuclear programs around the world. **A 2010 Government Accountability Office report found that the US share of exports of nuclear reactors, major components and equipment, and minor reactor parts fell 36 percent between 1994 and 2008—from an 11 percent share to 7 percent—and the US share of nuclear fuel exports fell from 29 percent to 10 percent in the same period.[23]**

Given that the Westinghouse AP1000 reactor builds in Georgia and South Carolina have gone very badly,[24] **if no US advanced reactor efforts succeed, the United States could be left without a reactor option to offer other countries under its nuclear cooperation agreements.** **This can only decrease the leverage the United States has to negotiate nonproliferation commitments with other countries in future cooperation agreements. This is especially true today as countries interested in nuclear power do not need to sign agreements with the United States in order to access viable supply chains for reactor programs**. It is hard to see why countries would allow America to set conditions on their civil nuclear energy programs—let alone higher ones than NSG standards dictate or that other supplier countries ask for—as part of US 123 agreements if the United States is not able to offer nations anything of value in return

#### Nuclear energy is important for war and national security

Nuclear Energy Institute 2024

Nuclear Energy Institute, leading U.S. policy and technical organization dedicated to all aspects of the commercial nuclear industry. “National Security

A strong U.S. nuclear energy industry is essential to our national security.” Last updated 2024. Last accessed 4/7/2025, Available here: (<https://test.nei.org/advantages/national-security>) - JB

**More of our nation’s top security experts are recognizing nuclear energy as a cornerstone of national security.** Why? **It ensures geopolitical leadership abroad, offers the U.S. a resilient grid without carbon emissions and supports our national defense.**

**Leading in Nuclear Energy Means Leading in the World.** A strong civil nuclear sector is important to America’s role in the world, as **our industry expertise has allowed us to set international rules for using nuclear technologies and keeping nuclear materials out of the hands of bad actors.** **Reactor exports allow the U.S. to form 100-year strategic relationships around the world that span the construction, operation and decommissioning of a plant. Today, however, the global landscape is rapidly shifting. Russia and, more recently, China have made great strides to develop their nuclear industries, both domestically and for the export market.** **With this expansion, they are poised to take leading roles in the establishment of global nuclear norms and standards in the future.** Russia, through state-owned and state-supported Rosatom, has brought seven reactors online in the past five years and today has three reactors under construction domestically. There are 16 reactors of Russian design under construction worldwide. This total includes reactors in Bangladesh, Belarus, India, Slovakia, Turkey and Ukraine. In just the past five years, China has brought 21 reactors on line and today has 13 additional plants under construction domestically. There are 14 reactors of Chinese design under construction worldwide. **China is aggressively becoming a supplier to the global market, with recent major deals in Argentina and the United Kingdom**.

HOW CAN WE COMPETE GLOBALLY? **Nuclear Keeps the Grid Online When Disaster Strikes.** **Nuclear power plants are among the most robust elements of U.S. critical infrastructure.** Because of the industry’s comprehensive safety procedures and stringent federal regulations, **nuclear plants offer a level of protection against natural and adversarial threats that goes far beyond most other elements of our nation’s electrical grid. They are built to withstand extreme weather, as proven during recent hurricanes and freezing temperatures driven by polar vortex events. Nuclear plants generate electricity 24/7/365. When other energy sources are stressed or unavailable, nuclear keeps the lights on.** Unlike most energy sources, **nuclear plants have up to two years of fuel stored securely on-site.** That makes nuclear power plants hardened against fuel supply disruptions.

PRESERVE NUCLEAR PLANTS**. Nuclear Energy Powers National Defense. We have the world’s largest nuclear-powered navy, and it’s supported by the U.S. commercial nuclear energy industry.** Allowing nuclear plants and fuel facilities to shut down will adversely affect a shared nuclear supply chain and our regional economies. **Since the U.S. Department of Defense depends on the grid to power 99 percent of its installations, nuclear energy’s reliability supports the nation’s ability to defend itself.** The Pentagon, with Congress’ encouragement, is considering micro-reactors to enhance domestic defense installations. **A changing climate has been identified by the national security community as a national security risk, and carbon dioxide emissions from other forms of electricity production contribute to changes in our climate. Nuclear energy is by far our nation’s largest source of emissions-free generation.**

## Extensions

#### The US needs to keep engaged in nuclear power

**Bowen 2020**

Dr. Bowen, Matt is a Senior Research Scholar at the Center on Global Energy Policy at Columbia University SIPA, focusing on nuclear energy, waste, and nonproliferation. “Why the United States Should Remain Engaged on Nuclear Power: Climate Change and Air Pollution”. Published by Center on Global Energy Policy at Columbia. June 11, 2020. Available here: ((https://www.energypolicy.columbia.edu/publications/why-united-states-should-remain-engaged-nuclear-power-climate-change-and-air-pollution/) – JB

**Nuclear power has the potential to help stem the advance of climate change and reduce air pollution by limiting the types of emissions that contribute to each.** **Despite its** provision of reliable electricity and **potential** to play an even larger role **in the fight against a warming planet and harmful pollution,** **nuclear power is facing headwinds in the United States, including mixed public acceptance, lack of progress on waste management, and cost overruns at new reactor builds.** These challenges cloud nuclear energy’s future in the United States at a time when much of the world is struggling to meet deep decarbonization goals and would benefit from American leadership.4

**Despite** increased **attention to the risks posed by climate change, global greenhouse gas emissions have not yet begun to decline significantly and in fact have continued to grow in recent years.** The failure of world governments to halt the rise of global warming emissions was noted in a 2019 United Nations publication that found “deeper and faster cuts are now required” and assessed that the world appears to be headed toward 3.9°C of warming by the end of the century

**In addition to climate benefits, new advanced reactors—particularly if they displaced coal-fired generation—would have air pollution benefits in the form of reduced** nitrogen oxides, sulfur dioxide, particulate matter, mercury, and other **pollutants. The retirement of existing nuclear reactors has been estimated in some studies to lead to substantial increases of air pollution with damage to nearby populations’ health. For example, a Respiratory Health Association and Clean Air Task Force analysis in 2019 found that the potential retirement of four nuclear power plants in Illinois would**, over a 10-year period**, lead to the following: [28] Between 1,200 and almost 2,700 premature deaths. Over 30,000 additional asthma attacks and other respiratory symptoms. Almost 140,000 work loss days. $10 to $24 billion in monetized damages. Conversely, the construction of new nuclear plants to displace existing coal generation would reduce current air pollution levels and prevent these types of associated effects on people’s health and the economy.**

#### Leaving nuclear energy behind is the wrong choice

Heisler 2023

Heisler, Jacob. Member of the Berkeley Economic Review Staff. “Why Leaving Nuclear Energy Behind is the Wrong Choice”. Published in the Berkeley Economic Review. January 26, 2023. Available here: (<https://econreview.studentorg.berkeley.edu/why-leaving-nuclear-energy-behind-is-the-wrong-choice/>) - JB

**The United States faces an energy crisis.** America’s reliance on fossil fuels causes irreparable environmental degradation that will only increase in magnitude the longer we depend on them. **However, we are currently unable to fully commit to renewable energy sources such as solar and wind power due to their inherent unreliability.** Once technology is developed to cheaply and efficiently harvest and store renewable energy, renewables can, should, and will become the main energy source from which the world runs. **At this time, the expansion of the nuclear power sector is the best solution to this issue.**

**In the years since, however, hardly any new power plants in the United States were developed,** and public perception towards nuclear power shifted dramatically, largely due to mismanaged nuclear accidents. The largest nuclear disaster in US history occurred when a reactor at [Three Mile Island](https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html) in Pennsylvania partially melted down in 1979. Seven years later, the deadliest and most destructive nuclear disaster took place in [Chernobyl](https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx). More recently, as a result of the 9.1 magnitude earthquake near Japan and the resulting tsunami in 2011, there was a meltdown and the release of radioactive material from [Fukushima](https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx). These **incidents have been scrutinized to a level disproportionate to their actual human, financial, and environmental toll, and thus the prospect of a nuclear dominated future has become undesirable for many.**

**If the United States decided to make a concerted effort to grow the nuclear sector, there would be some key short-term economic costs and long-term benefits. The transition to an electricity-dominated nation that is powered in large part by nuclear power would be very expensive.**

#### Nuclear plants are safe

World Nuclear Association 2024

World Nuclear Association. Non-profit organization that provides information and resources about nuclear power and the nuclear industry. “Safety of Nuclear Power Reactors”. August 23, 2024. Available here: (<https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors>) - JB

**No industry is immune from accidents, but all industries learn from them. In civil aviation, there are accidents every year and each is meticulously analysed. The lessons from nearly one hundred years’ experience mean that reputable airlines are extremely safe.** In the chemical industry and oil-gas industry, major accidents also lead to improved safety**. There is wide public acceptance that the risks associated with these industries are an acceptable trade-off for our dependence on their products and services. With nuclear power, the high energy density makes the potential hazard obvious, and this has always been factored into the design of nuclear power plants.** The few accidents have been spectacular and newsworthy, but of little consequence in terms of human fatalities. The novelty value and hence newsworthiness of nuclear power accidents remains high in contrast with other industrial accidents, which receive comparatively little news coverage. **Of all the accidents and incidents, only the Chernobyl and Fukushima accidents resulted in radiation doses to the public greater than those resulting from the exposure to natural sources.** The Fukushima accident resulted in some radiation exposure of workers at the plant, but not such as to threaten their health, unlike Chernobyl. Other incidents (and one 'accident') have been completely confined to the plant. **The safety of operating staff is a prime concern in nuclear plants. Radiation exposure is minimised by the use of remote handling equipment for many operations in the core of the reactor. Other controls include physical shielding and limiting the time workers spend in areas with significant radiation levels. These are supported by continuous monitoring of individual doses and of the work environment to ensure very low radiation exposure compared with other industries. The use of nuclear energy for electricity generation can be considered extremely safe. Every year several hundred people die in coal mines to provide this widely used fuel for electricity. There are also significant health and environmental effects arising from fossil fuel use. Contrary to popular belief, nuclear power saves lives by displacing fossil fuel from the electricity mix.**

#### Nuclear energy is better for the environment and is highly reliable

ANT EPRI 2023

Advaned Nuclear Technology, Electric Power Research Institute. Program that conducts research to accelerate the deployment of new nuclear energy facilities around the world. “Is Nuclear Energy Good or Bad for the Environment?”. Last Updated 2025. Last accessed 4/7/2025. Available here: (<https://ant.epri.com/article/nuclear-good-bad-environment>) - JB

**Emissions from nuclear energy are significantly lower than fossil fuels.** Fully measuring and quantifying emissions from a nuclear plant requires a life-cycle analysis. This involves tallying the total amount of emissions related to every aspect of plant construction, operation, and decommissioning, from preparing the land to completing decommissioning, and including things like materials, transportation, and waste disposal. Estimates of life-cycle emissions of nuclear energy range from 2 tonsCO2 per GWh to about 130 tonsCO2 per GWh. The average estimates (29 tonsCO2 per GWh) suggest that nuclear energy releases about as much CO2 emissions-per-unit energy as wind (26 tonsCO2 per GWh) and about ⅓ as much as solar (85 tonsCO2 per GWh). Although precisely determining life-cycle emissions is challenging, it seems reasonable to conclude that CO2 emissions from nuclear, wind, and solar photovoltaic are comparable. Importantly, all estimates agree that emissions from nuclear energy are significantly lower than fossil fuels — which range from 499 tonsCO2 per GWh for natural gas to 1,054 tonsCO2 per GWh for brown coal.

Nuclear energy has a small land footprint. **A single nuclear reactor, built with today’s designs, generates about 1 GW of electricity with a plant area slightly larger than a square mile. It produces this energy at least 90% of the time. In order to generate the same amount of electricity as a nuclear plant, wind power requires a land area up to 360 times larger, and a solar plant would require up to 75 times more land to reach the same electric output.** Considering the enormous amounts of land that would be required to scale wind and solar energy, **nuclear is an attractive clean energy source due to its small, highly efficient land footprint.**

**Nuclear energy produces minimal waste. Environmental groups often express concerns about nuclear waste. Used nuclear fuel contains a handful of isotopes that will remain radioactive for hundreds of thousands of years, such as plutonium. However, used nuclear fuel is relatively small in volume, making it more manageable to deal with. If all the used fuel from 60 years of nuclear power generation in the U.S. were put together, it would fit on a football field and rise less than 10 yards high.** **There are three solutions that will make nuclear waste management even easier in the years to come: repositories, reprocessing, and recycling.** Repositories can be dug in remote areas with stable geology to safely isolate nuclear materials for millions of years. Used nuclear fuel can also be reprocessed. Reprocessing means separating the plutonium and other useful materials from the used fuel and refabricating it into new fuel assemblies, significantly reducing waste volumes. Innovations in reactor design and advanced nuclear technology are starting to put recycling nuclear waste closer within reach. Beyond plutonium, all heavy radioactive isotopes in used nuclear fuel could be consumed in specialized waste-burning fast reactors.

**Nuclear energy is reliable. In 2021, U.S. nuclear plants operated 92.7% of the time. Global reliability factors for nuclear power plants are consistently above 90%. While other energy sources can struggle with intermittency, nuclear plants consistently and reliably provide energy that can meet the demand and needs of the grid.**

#### Nuclear must be a part of the energy solution

Rhodes 2018

Rhodes, Richard. An author of numerous books, including Energy: A Human History, and is the winner of the Pulitzer Prize, the National Book Award, and the National Book Critics Circle Award. “Why Nuclear Power Must Be Part of the Energy Solution”. Published in the Yale Energy Journal. July 9, 2018. Available here: (<https://e360.yale.edu/authors/richard-rhodes>.) - JB

**A final complaint against nuclear power is that it costs too much.** Whether or not nuclear power costs too much will ultimately be a matter for markets to decide, but **there is no question that a full accounting of the external costs of different energy systems would find nuclear cheaper than coal or natural gas**. Nuclear power is not the only answer to the world-scale threat of global warming. Renewables have their place; so, at least for leveling the flow of electricity when renewables vary, does natural gas. But **nuclear deserves better than the anti-nuclear prejudices and fears that have plagued it. It isn’t the 21st century’s version of the Devil’s excrement. It’s a valuable, even an irreplaceable, part of the solution to the greatest energy threat in the history of humankind.**

#### 4 Benefits of Small Modular Reactors (SMRs)

Oguz 2024

Oguz, Selin. Content writer with a focus on sustainability, energy and climate change. She is the lead writer for Visual Capitalist's Decarbonization Channel. “Visualized: The Four Benefits of Small Modular Reactors” Published by Decarbonization Channel. April 16, 2024. Available here: (<https://decarbonization.visualcapitalist.com/visualized-the-four-benefits-of-small-modular/#:~:text=SMRs%20have%20greater%20siting%20flexibility,per%20unit%20of%20land%20area>) - JB

**Nuclear power has a crucial role to play on the path to net zero.** Traditional nuclear plants, however, can be costly, resource-intensive, and take up to 12 years to come online. **Small modular reactors (SMR) offer a** possible **solution**. The Four Key Benefits of SMRs, Explained. **An SMR is a compact nuclear reactor that is typically less than 300 megawatts electric (MWe) in capacity and manufactured in modular units. Here are some of the benefits they offer.**

#1: **Lower Costs. SMRs require a lower upfront capital investment due to their compact size.** **SMRs can also match the per-unit electricity costs of traditional reactors due to various economic efficiencies related to their modular design,** including design simplification, factory fabrication, and potential for regulatory harmonization.

#2: **Quicker Deployment.** Traditional nuclear plants can take up to 12 years to become operational. This is primarily due to their site-specific designs and substantial on-site labor involved in construction. **SMRs**, on the other hand, **are largely manufactured in factories and are location-independent, which minimizes on-site labor and expedites deployment timelines to as little as three years.** **This means they can be deployed relatively quickly to provide emissions-free electricity to the grid, supporting growing electricity needs.**

#3**: Siting Flexibility and Land Efficiency. SMRs have greater siting flexibility compared to traditional reactors due to their smaller size and modular design.** In addition, they can utilize land more effectively than traditional reactors, yielding a higher output of electrical energy per unit of land area. **Given their flexibility, SMRs are also** [**suitable**](https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/small-nuclear-power-reactors.aspx) **for installation on decommissioned coal power plant sites, which can support the transition to clean electricity while utilizing existing transmission infrastructure**.

**#4: Safety. SMRs have simpler designs, use passive cooling systems, and require lower power and operating pressure**, making them inherently [safer to operate](https://www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs) than traditional reactors. **They also have different refueling needs** compared to traditional plants, **needing refueling every 3–7 years** instead of the 1–2 years typical for large plants. T**his minimizes the transportation and handling of nuclear fuel, mitigating the risk of accidents.**

The Road Ahead. As of early 2024, only [five](https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/small-nuclear-power-reactors.aspx) SMRs are operating worldwide. But with several other projects under construction and nearly 20 more in advanced stages of development, **SMRs hold promise for expanding global emission-free electricity capacity.** With that said, certain obstacles remain for the wide-scale adoption of SMRs in the United States, which was particularly apparent in the 2023 [cancellation](https://www.nuscalepower.com/en/news/press-releases/2023/uamps-and-nuscale-power-agree-to-terminate-the-carbon-free-power-project) of the NuScale SMR project. **To fully realize the benefits of SMRs and advance decarbonization efforts, a focus on financial viability, market readiness, and broader utility and public support may be essential.**

#### SMRs are an alternative that solves high costs, security and efficiency

Department Of Energy 2024

US Department of Energy. The Department of Energy (DOE) manages the United States' nuclear infrastructure and administers the country's energy policy. The Department of Energy also funds scientific research in the field. “Benefits of Small Modular Reactors (SMRs)”. Published by the Office of Nuclear Energy. September 5, 2024. Last accessed 4/7/2025. Available here: (<https://www.energy.gov/ne/benefits-small-modular-reactors-smrs>) - JB

**Small modular reactors offer a lower initial capital investment, greater scalability, and siting flexibility for locations unable to accommodate more traditional larger reactors. They also have the potential for enhanced safety and security compared to earlier designs. Deployment of advanced SMRs can help drive economic growth.**

**MODULARITY. The term “modular” in the context of SMRs refers to the ability to fabricate major components of the nuclear steam supply system in a factory environment and ship to the point of use**. Even though current large nuclear power plants incorporate factory-fabricated components (or modules) into their designs, a substantial amount of field work is still required to assemble components into an operational power plant. **SMRs are envisioned to require limited on-site preparation and substantially reduce the lengthy construction times that are typical of the larger units. SMRs provide simplicity of design, enhanced safety features, the economics and quality afforded by factory production, and more flexibility** (financing, siting, sizing, and end-use applications) compared to larger nuclear power plants. **Additional modules can be added incrementally as demand for energy increases.**

**LOWER CAPITAL INVESTMENT. SMRs can reduce a nuclear plant owner’s capital investment due to the lower plant capital cost. Modular components and factory fabrication can reduce construction costs and duration.**

**SITING FLEXIBILITY. SMRs can provide power for applications where large plants are not needed or sites lack the infrastructure to support a large unit.** This would include smaller electrical markets, isolated areas, smaller grids, sites with limited water and acreage, or unique industrial applications**. SMRs are expected to be attractive options for the replacement or repowering of aging/retiring fossil plants, or to provide an option for complementing existing industrial processes or power plants with an energy source that does not emit greenhouse gases.**

**GREATER EFFICIENCY. SMRs can be coupled with other energy sources, including renewables and fossil energy, to leverage resources and produce higher efficiencies and multiple energy end-products while increasing grid stability and security**. Some advanced SMR designs can produce a higher temperature process heat for either electricity generation or industrial applications.

**SAFEGUARDS & SECURITY / NONPROLIFERATION. SMR designs have the distinct advantage of factoring in current safeguards and security requirements.** **Facility protection systems, including barriers that can withstand design basis aircraft crash scenarios and other specific threats, are part of the engineering process being applied to new SMR design. SMRs also provide safety and potential nonproliferation benefits to the United States and the wider international community.** **Most SMRs will be built** below grade for safety and security enhancements, **addressing vulnerabilities to both sabotage and natural phenomena hazard scenarios. Some SMRs will be designed to operate for extended periods without refueling.** **These SMRs could be fabricated and fueled in a factory, sealed and transported to sites for power generation or process heat, and then returned to the factory for defueling at the end of the life cycle. This approach could help to minimize the transportation and handling of nuclear material.** Light water-based SMRs are expected to be fueled with low enriched uranium, i.e., approximately 5 percent U-235, similar to existing large nuclear power plants. The “security by design” concepts being applied to these technologies are expected to increase SMR resistance to theft and diversion of nuclear material. Also, reactor cores for these light water SMRs can be designed to burn plutonium as a mixed oxide (MOX) fuel. Further, SMRs based on non-light water reactor coolants could be more effective at dispositioning plutonium while minimizing the wastes requiring disposal.

**U.S. INDUSTRY, MANUFACTURING, AND JOB GROWTH. The case for SMR economic competitiveness is rooted in the concept that mass manufacture of modular parts and components will reduce the cost per kilowatt of electricity on par with current generating sources. There is both a domestic and international market for SMRs, and U.S. industry is well positioned to compete for these markets. DOE hopes that the development of standardized SMR designs will also result in an increased presence of U.S. companies in the global energy market. If a sufficient number of SMR units were ordered, it would provide the necessary incentive to develop the appropriate factory capacity to further grow domestic and international sales of SMR power plants.**

**ECONOMIC DEVELOPMENT. SMR deployment to replace retiring electricity generation assets and meet growing generating needs would result in significant growth in domestic manufacturing, tax base, and high-paying factory, construction and operating jobs. A 2010[1] study on economic and employment impacts of SMR deployment estimated that a prototypical 100 MWe SMR costing $500 million to manufacture and install would create nearly 7,000 jobs and generate $1.3 billion in sales, $404 million in earnings (payroll), and $35 million in indirect business taxes. The report examines these impacts for multiple SMR deployment rates, i.e., low (1-2 units/year), moderate (30 units/year), high (40 units/year), and disruptive (85 units/year). The study indicates significant economic impact would be realized by developing an SMR manufacturing enterprise at even moderate deployment levels.**

# Negative

Resolved: The United States federal government should substantially increase its investment in domestic nuclear energy.

*Definitions*

Investment: the outlay of money usually for income or profit:capital outlay. (Merriam Webster, https://www.merriam-webster.com/dictionary/investment)

Domestic: of, relating to, or originating within a country. (Merriam Webster, https://www.merriam-webster.com/dictionary/domestic)

Nuclear energy: Nuclear energy is the energy in the nucleus, or core, of an atom. Nuclear energy can be used to create electricity, but it must first be released from the atom. In the process of nuclear fission, atoms are split to release that energy. A nuclear reactor, or power plant, is a series of machines that can control nuclear fission to produce electricity. (National Geographic, https://education.nationalgeographic.org/resource/nuclear-energy/)

**Framework**

**Cost-benefit analysis**

The framing for today’s round ought to be cost benefit analysis. If we demonstrate that the United States substantially increasing investing in domestic nuclear energy creates more harm than good, we should win the round.

## Counter contention 1: Costs

#### Utah nuclear plans are expensive

Peterson 2025

Peterson, Eric. Executive director at The Utah Investigative Journalism Project. He has been an investigative reporter in Utah for the past decade. ”Glowing pains: Developing nuclear power could cost Utah tens of billions”. Published by Utah News Dispatch. March 10, 2025. Available here: (<https://utahnewsdispatch.com/2025/03/10/glowing-pains-developing-nuclear-power-could-cost-utah-tens-of-billions/>) - JB

 **If Utah sought, for example, to double its energy capacity with nuclear (adding four new gigawatts) it would come with a hefty price tag. “The rough number would be $40 billion,”** Kemp said in a recent interview. **Half of that amount, or two gigawatts, would likely be a little over $20 billion. By comparison Utah’s total state budget for 2025 is around $30 billion.** **Those numbers track closely with estimates from other experts locally and out of the state.** **The Colorado Springs Utilities policy advisory committee released a report** in February **estimating that the costs for small modular nuclear reactor projects** that could deliver 600 megawatts (60% of a gigawatt) **would be between $7 billion and $12.9 billion. And the small modular nuclear reactor, or SMR, is still a concept that has not yet been successfully built or used. The Vogtle modular nuclear plant built in Georgia was estimated to cost $17 billion when it was started in 2009 but when it came online in 2024, it ended up costing over $30 billion**. Kemp says the project is the nation’s most expensive energy project.

#### Georgia nuclear plans were unexpectedly long and expensive

Amy 2023

Amy, Jeff. Covers Georgia politics and state government for The Associated Press. He began work with the AP in 2011 and covered Mississippi for eight years before transferring to the Atlanta bureau in 2019. “Georgia nuclear rebirth arrives 7 years late, $17B over cost”. Published in AP News. May 25, 2023. Available here: (<https://apnews.com/article/georgia-nuclear-power-plant-vogtle-rates-costs-75c7a413cda3935dd551be9115e88a64>) - JB

**Two nuclear reactors in Georgia were supposed to herald a nuclear power revival in the United States. But the project is seven years late and $17 billion over budget as Georgia Power Co. announced the first new reactor at its Plant Vogtle could reach full electrical output by Saturday. They’re the first U.S. reactors built from scratch in decades — and maybe the most expensive power plant ever.** **Georgia electric customers have** already **paid billions, and state regulators will ultimately decide if they’re on the hook for billions more.** **Some of the key promises of Vogtle** — like building modules offsite and shipping them for cheaper on-site assembly — **did not pan out.** Construction delays drove Westinghouse Electric Co., a titan of American industrial history, into bankruptcy when the company couldn’t absorb overruns**. In Georgia, almost every electric customer will pay for Vogtle.** Georgia Power currently owns 45.7% of the reactors. Smaller shares are owned by Oglethorpe Power Corp., which provides electricity to member-owned cooperatives, the Municipal Electric Authority of Georgia and the city of Dalton. **Some Florida and Alabama utilities have also contracted to buy Vogtle’s power. Currently, the owners are projected to pay $31 billion in capital and financing costs,** Associated Press calculations show.

## Counter contention 2: Meltdowns

#### Chernobyl

Dizikes 2019

Dizikes, Peter. Writer for MIT based research. “Chernobyl: How bad was it?”. Published by MIT News. March 5, 2019. Available here: (<https://news.mit.edu/2019/chernobyl-manual-for-survival-book-0306>) - JB

**Not long after midnight on April 26, 1986, the world’s worst nuclear power accident began. Workers were conducting a test at the Chernobyl Nuclear Power Plant in the Ukraine when their operations spun out of control.** Unthinkably, the core of the plant’s reactor No. 4 exploded, first blowing off its giant concrete lid, then letting a massive stream of radiation into the air. Notoriously, the Soviet Union kept news of the disaster quiet for a couple of days. **By the time the outside world knew about it, 148 men who had been on the Chernobyl site — firefighters and other workers — were already being treated in the special radiation unit of a Moscow hospital.** And that was just one sliver of the population that wound up seeking medical care after Chernobyl. **By the end of the summer of 1986, Moscow hospitals alone had treated about 15,000 people exposed to Chernobyl radiation. The Soviet republics of Ukraine and Belarus combined to treat about 40,000 patients in hospitals due to radiation exposure in the same period of time; in Belarus, about half were children. And while 120,000 residents were hastily evacuated from the “Zone of Alienation” around Chernobyl, about 600,000 emergency workers eventually went into the area,** trying to seal the reactor and make the area safe again. **About 31,000 soldiers camped out near the reactor, where radioactivity reached about 1,000 times the normal levels within a week, and contaminated the drinking water.** Still, in “Manual for Survival,” Brown does suggest that the higher end of existing death estimates seems plausible. **The Ukrainian state pays benefits to about 35,000 people whose spouses apparently died from Chernobyl-caused illnesses. Some scientists have told her they think 150,000 deaths is a more likely baseline for the Ukraine alone.** (There are no official or unofficial counts for Belarus and western Russia.)

#### Nuclear Meltdowns are dangerous not only for humans but also for wildlife

Fairewinds 2022

Fairewinds Energy Education. Non-profit organization that provides information on nuclear energy. “What is a Meltdown?”. Published by Energy Education. Last Updated in 2022. Last accessed 4/7/2025. Available here: (<https://www.fairewinds.org/what-is-a-meltdown>) - JB

**A nuclear meltdown is the worst case scenario for a nuclear power plant, causing widespread releases of deadly radiation into the environment that can spread hundreds of miles away impacting wildlife as well as humans.** **Radiation can not be seen, smelled, or tasted and exposure can lead to serious side effects such as hair loss, skin blisters, tumors, and cancer and if the dose is large enough, death. Since 1952 there have been fourteen meltdowns** of varying severity at both commercial, military, and experimental reactors. The top three most disastrous meltdowns include Three Mile Island in 1979, Chernobyl in 1986, and Fukushima Daiichi in 2011. **It is important to remember that a nuclear meltdown isn't a singular tragic event as is often the case with natural disasters. The effects of a meltdown can last for hundreds of years as the radiation slowly decays.**

What actually causes a meltdown? A meltdown occurs in a reactor when the fuel isn't being adequately cooled. The fuel rods are kept submerged underwater, with the water acting as a coolant. If the heat generated from the fission reaction is so great that it causes a majority of the water to boil off exposing the fuel rods to air. The Uranium pellets in the rod quickly become so hot that they reach their melting point, burning through the zirconium fuel rod casing and the containment chamber floor causing a widespread release of radiation.

## Counter contention 3: CO2

#### Nuclear power is not zero emissions

Weber 2021

Weber, Joscha. Editor of Deutsche Welle. “Fact check: Is nuclear energy good for the climate?”. Published by Deutsche Welle. November 29, 2021. Available here: (<https://www.dw.com/en/fact-check-is-nuclear-energy-good-for-the-climate/a-59853315>) - JB

**Is nuclear power a zero-emissions energy source? No.** **Nuclear energy is also responsible for greenhouse gas emissions.** In fact, no energy source is completely free of emissions, but more on that later. **When it comes to nuclear, uranium extraction, transport and processing produces emissions. The long and complex construction process of nuclear power plants also releases CO2, as does the demolition of decommissioned sites. And, last but not least, nuclear waste also has to be transported and stored under strict conditions — here, too, emissions must be taken into account.**

And yet, interest groups claim nuclear energy is emission-free. Among them is Austrian consulting firm ENCO. In late 2020, it released a study prepared for the Dutch Ministry of Economic Affairs and Climate Policy that looked favorably at the possible future role of nuclear in the Netherlands. "The main factors for its choice were reliability and security of supply, with no CO2 emission," it read. ENCO was founded by experts from the International Atomic Energy Agency, and it regularly works with stakeholders in the nuclear sector, so it's not entirely free of vested interests. **At COP26, environmental initiative Scientists for Future (S4F) presented a paper on nuclear energy and the climate. The group came to a very different conclusion. "Taking into account the current overall energy system, nuclear energy is by no means CO2 neutral,"** they said. Ben Wealer of the Technical University of Berlin, **one of the report's authors, told** DW that proponents of nuclear energy **"fail to take into account many factors," including those sources of emissions outlined above**. All the studies reviewed by DW said the same thing: Nuclear power is not emissions-free.

#### Uranium mining harms the environment, wildlife and humans

Montgomery 2025

Montgomery, Ellen. Director of Environment America. Good, Quentin. Policy Analyst for the Frontier Group. “Renewed interest in uranium mining threatens waterways and wildlife”. Published by Environment America. January 20, 2025. Available here: (https://environmentamerica.org/articles/renewed-interest-in-uranium-mining-threatens-waterways-and-wildlife/) - JB

**Mining for and processing uranium ore both present serious risks to our waterways and wildlife. In addition, transporting highly radioactive uranium ore from mines to mills on public roads – many of which cut through native reservations that have long been plagued by the long-term health impacts of uranium mining – is a toxic spill waiting to happen. Uranium mines produce radioactive water polluted with arsenic, uranium and other toxic substances.** This water is typically stored in open air wastewater tanks called impoundments where it is meant to slowly evaporate. But such impoundments are often only protected by a fence. **Animals, especially small animals and birds, can easily drink from these highly toxic ponds, exposing them to dangerous levels of radiation**. Uranium mines have also discarded waste rock outside of impoundments. **Wind can pick up radioactive dust from these rocks, spreading it far and wide into lakes and streams, animal habitats and human settlements. Once uranium is mined,** uranium mills use chemicals to dissolve and separate uranium from crushed ore. **This process leaves behind toxic compounds called tailings that are poured into massive ponds on site.** **Transporting uranium from mine to mill poses serious health risks to communities located en route to the destination.** The 300-mile route from Pinyon Plain mine to the White Mesa Mill includes segments of highway where fatal traffic accidents are 240%-700% higher than average, and four out of five of the most dangerous stretches of road are in the Navajo Nation. **Past uranium mining and the resulting exposure to radiation has left a “legacy of harm” for the Navajo people – from cancer to respiratory illnesses. Further risks of contamination are simply unacceptable. Nuclear advocates argue that these problems are a thing of the past because uranium mines and mills are now highly regulated. However, the case of the White Mesa Mill demonstrates that uranium production continues to have long-lasting environmental and health impacts today.** The Denver Post reports that since 1999, the mill has been cited at least 40 times for violations by Utah regulators, including for discharging pollutants into waterways. Testing wells near the site have regularly found levels of uranium, nitrates, cadmium and nickel above Utah state limits; one well had concentrations of uranium more than six times the federal limit for drinking water. Some residents of the nearby town of White Mesa, sensibly, prefer bottled water. The harms of uranium mining are clear: contamination of the air, water and soil, as well as damage to wildlife and communities. The push for new nuclear power cannot mean expanding the toxic footprint of uranium mining across even more of the West.

## Extensions

#### 6 reasons why nuclear energy is not good

Leman 2022

Leman, Medhi. Content editor for Greenpeace International based in France. “6 reasons why nuclear energy is not the way to a green and peaceful world”. Published by Greenpeace. March 18, 2022. Available here: (<https://www.greenpeace.org/international/story/52758/reasons-why-nuclear-energy-not-way-green-and-peaceful-world/>) - JB

1. **Nuclear energy delivers too little to matter. In order to tackle climate change, we need to reduce fossil fuels in the total energy mix well before 2050 to 0%.** According to scenarios from the World Nuclear Association and the OECD Nuclear Energy Agency (both nuclear lobby organisations), **doubling the capacity of nuclear power worldwide in 2050 would only decrease greenhouse gas emissions by around 4%.** **But in order to do that, the world would need to bring 37 new large nuclear reactors to the grid every year from now, year on year, until 2050. The last decade only showed a few to 10 new grid connections per year.** **Ramping that up to 37 is physically impossible** – there is not sufficient capacity to make large forgings like reactor vessels. There are currently only 57 new reactors under construction or planned for the coming one-and-a-half decade. **Doubling nuclear capacity** – different from the explosive growth of clean renewable energy sources like solar and wind – **is therefore unrealistic.** And that **for only 4% when we** already **need** to reduce **100%.**

2. **Nuclear power plants are dangerous and vulnerable. Nuclear factories and plants are easy targets for malevolent acts: terrorist threats, the risk of unintentional or voluntary airliner crashes, cyberattacks or acts of war.** **The enclosures of plants and certain ancillary buildings containing radioactive materials are not designed to withstand this type of attack or shock. Nuclear power plants present unique hazards in terms of the potential consequences resulting from a severe accident. Nuclear reactors and their associated high level spent fuel stores are vulnerable to natural disasters, as Fukushima Daiichi showed, but they are also vulnerable in times of military conflict.** For the first time in history, **a** **major war is being waged in a country with multiple nuclear reactors and thousands of tons of highly radioactive spent fuel. The war in southern Ukraine around Zaporizhzhia puts them all at heightened risk of a severe accident.** **Nuclear power plants** are some of the most complex and sensitive industrial installations, which **require a very complex set of resources in ready state at all times to keep them operational. This cannot be guaranteed in a war. This can’t be guaranteed in a time of climate crisis and extreme weather events either. Nuclear power is a water-hungry technology. Nuclear power plants consume a lot of water for cooling. They are vulnerable to water stress, the warming of rivers, and rising temperatures, which can weaken the cooling of power plants and equipment**. **Nuclear reactors in the United States** and France **are often shut down during heatwaves, or see their activity drastically slowed.**

3. **Nuclear energy is too expensive. To protect the climate, we must abate the most carbon at the least cost and in the least time. The cost of generating solar power ranges from $36 to $44 per megawatt-hour (MWh),** the World Nuclear Industry Status Report said, **while onshore wind power comes in at $29–$56 per MWh. Nuclear energy costs between $112 and $189 per MWh.** **Over the past decade**, the World Nuclear Industry Status Report estimates levelised costs – which compare **the total lifetime cost of building and running a plant to lifetime output – for utility-scale solar have dropped by 88% and for wind by 69%.** According to the same report, **these costs have increased by 23% for nuclear. \*** According to a November 2021 study released by Greenpeace France and the Rousseau Institute, power from the under-construction European Pressurised Reactor (EPR) at Flamanville in France would be 3 times as expensive as the country’s most competitive renewable sources.

4**. Nuclear energy is too slow.** Stabilising the **climate is an emergency**. Nuclear power is slow. The 2021 World Nuclear Industry Status Report estimates that **since 2009 the average construction time for reactors worldwide was just under 10 years, well above the estimate given by the World Nuclear Association (WNA) industry body of between 5 and 8.5 years.** **The extra time that nuclear plants take to build has major implications for climate goals, as existing fossil-fueled plants continue to emit CO2 while awaiting substitution. The construction of a nuclear plant is a long and complex process that obviously releases CO2, as does the demolition of decommissioned nuclear sites. Uranium extraction, transport and processing is obviously not free of greenhouse gas emissions either.** All in all, nuclear power stations score comparable with wind and solar energy. But this latter can be implemented much faster and on a much bigger scale. **We cannot wait for another decade for emissions to go down. They need to go down now.** With clean renewable sources and energy efficiency, we can do that.

5. **Nuclear energy generates huge amounts of toxic waste.** **The multiple stages of the nuclear fuel cycle produce large volumes of radioactive waste. No government has yet resolved how to safely manage this waste. Some of this nuclear waste is highly radioactive and will remain so for several thousand years**. **Nuclear waste is a real scourge for our environment and for future generations, who will still have the responsibility of managing it in several centuries.** Countries like France are pushing hard for nuclear power at the EU level, hoping that when it comes to waste, out of sight is out of mind. **But nuclear waste will never go away, and will never be sustainable. This is one of the obvious reasons why nuclear power shouldn’t be eligible for green funding nor marketed as ‘sustainable’**, as pointed out recently by countries like Austria, Denmark, Germany, Luxembourg, and Spain, who spoke against the inclusion of nuclear power in the EU’s green finance taxonomy. This is also one of the reasons why, on 9 March 2020, the EU Commission’s Technical Expert Group on Sustainable Finance (TEF) rejected nuclear energy because it did not meet the EU’s ‘Do No Significant Harm’ principle and recommended excluding nuclear power from the green taxonomy. **Nuclear waste management is costing taxpayers absurd amounts of money, costs for storage projects reaching into the billions. This is true** both **for** Europe and **North America. In 2019, a US Energy Department report showed the projected cost for long-term nuclear waste cleanup jumped more than $100 billion in just one year.**

6. **The nuclear industry is falling short of its promises**. The EPR nuclear reactor technology has been showcased by the French government and French nuclear operator EDF as a revolutionary technology announcing the dawn of a nuclear renaissance. The reality is that this technology isn’t any kind of technological leap. More importantly, the French EPR reactor located in Flamanville is more than 10 years overdue and nearly four times over budget. This so-called “next-generation nuclear reactor”, has also sustained multiple problems, delays and cost overruns in France, the United Kingdom, Finland and China. **Hypothetical new nuclear power technologies have been promised to be the next big thing for the last forty years, but in spite of massive public subsidies, that prospect has never panned out. That is also true for Small Modular Reactors (SMRs). And for nuclear fusion, an idea that is as old as the nuclear industry, which somehow always seems to be fifty years away.** **The cost and uncertainty of fusion mean investing in thermonuclear reactors at the expense of other available clean energy options. This technology won’t arrive in time, if ever, and the money would be better invested elsewhere. Let’s exert the utmost caution when presented with pro-nuclear opinions coming from experts and organisations regularly working with stakeholders from the nuclear sector and potentially tainted by vested interests. Nuclear energy has no place in a safe, clean, sustainable future. It is more important than ever that we steer away from false solutions and leave nuclear power in the past.**

#### Nuclear Energy is not Clean

Public Citizen 2022

Public Citizen. US based is a nonprofit consumer advocacy organization. “Nuclear Power Is Not Clean or Green!”. Published by Public Citizen. Last Updated 2022. Last accesed 4/7/2025. Available here: (<https://www.citizen.org/article/nuclear-power-is-not-clean-or-green/>) - JB

The Real Dirt on “Clean” Nuclear Energy. **The mining, milling and enrichment of uranium into nuclear fuel are extremely energy-intensive and result in the emission of carbon dioxide into the atmosphere from the burning of fossil fuels.** **Estimated “energy recovery time” for a nuclear power plant is about 10 to 18 years,** depending on the richness of uranium ores mined for fuel**. This means that a nuclear power plant must operate for at least a decade before all the energy consumed to build and fuel the plant has been earned back and the power station begins to produce net energy.** **By comparison, wind power takes less than a year to yield net energy, and solar or photovoltaic power nets energy in less than three years.** The Nuclear Regulatory Commission has calculated that **collective radiation doses amounting to 12 cancer deaths can be expected for each 20-year term a reactor operates, as a result of radioactive emissions from the nuclear fuel cycle and routine reactor operations.** **This calculation assumes no unplanned accidents and does not consider radiation releases from high-level nuclear waste “disposal” activities. Nor are nonfatal health impacts related to radiation exposure counted in this tally.** **Thermal pollution from nuclear power plants adversely affects marine ecosystems.** “Once-through” cooling systems in use at half the U.S. nuclear reactors discharge billions of gallons of water per day at temperatures up to 25 degrees Fahrenheit hotter than the water into which it flows.

#### Cost of Nuclear is high

American Progress 2008

American Progress. Independent, nonpartisan policy institute. “10 Reasons Not to Invest In Nuclear Energy”. Published by American Progress. July 8, 2008. Available here: (<https://www.americanprogress.org/article/10-reasons-not-to-invest-in-nuclear-energy/>) - JB

**Nuclear faces prohibitively high**—and escalating—**capital costs. Nuclear power plant construction costs—**mainly materials, labor, and engineering—r**ose by 185 percent between 2000 and 2007.** More recently, costs have been increasing even faster: **In mid-March, Progress Energy informed state regulators that the twin 1,100 MW nuclear plants it intends to build in Florida would cost $14 billion, which “triples estimates the utility offered little more than a year ago.”** Jim **Harding, former director of power planning and forecasting for Seattle City Light,** **estimates that nuclear plants constructed today would provide electricity at between 12 and 17 cents per kilowatt-hour. To put this cost into perspective, the average U.S. electricity price in 2006 was 8.9 cents per kWh, and well-placed wind turbines can produce electricity for less than 5 cents per kWh.** In August, 2007, the Tulsa World reported that American Electric Power Co. CEO Michael Morris was not planning to build any new nuclear power plants. He was quoted as saying, “I’m not convinced we’ll see a new nuclear station before probably the 2020 timeline,” citing “realistic” costs of about $4,000 per kilowatt. **Since then, the prices utilities are quoting for nuclear have soared 50 percent to 100 percent.**

#### Nuclear Energy Hazards

Friends Of The Earth 2024

[Friends](https://uofutah-my.sharepoint.com/personal/u1545217_umail_utah_edu/Documents/Friends) of the Earth (FOE). Friends of the Earth U.S. is a non-governmental environmental organization headquartered in Washington, D.C. “Is Nuclear Power Bad For the Environment”. Published by FOE. Last Updated 2024. Last accesed 4/7/2025. Available here: (<https://foe.org/blog/is-nuclear-power-bad-for-the-environment/>) - JB

**Is nuclear power bad for the environment? Yes. Is it a threat to public health and environmental justice? Yes. Is it also dangerous and expensive? Yes.**

Nuclear Energy Definition Electricity from nuclear power plants is generated through the process of nuclear fission. This occurs when a neutron hits the nucleus of certain atoms, splitting the nucleus into smaller nuclei, producing other neutrons, which then hit other atoms, creating more nuclei and more neutrons, resulting in a chain reaction within a nuclear reactor core. This releases massive amounts of energy as heat, radiation, and radioactive waste. The heat generated is used to boil water to create steam, which then turns an electric turbine to create electricity. Nuclear power plants require “enriched uranium” for their fuel to sustain the fission reaction and produce electricity. Naturally occurring uranium must be “enriched” to increase the concentration of the fission-able (“fissile”) isotope of uranium (U-235). According to the US Energy Information Administration, as of July 2024, there are 94 active commercial nuclear reactors at 54 nuclear power plants.

**Nuclear Hazards – Waste.** **The production and use of nuclear power produces waste at every step of the process. Waste produced in nuclear power plants is radioactive and remains so for many** thousands of **years. There is no safe way to dispose of this radioactive waste, and it has piled up for decades** at nuclear facilities. **Spent nuclear fuel** (i.e., old fuel removed from reactors) **can be dangerous for thousands-to-millions of years. According to the Nuclear Information and Resource Service, “For every pound of “enriched” uranium that goes into a nuclear reactor, there are, on average, over 5,000 pounds of radioactive waste…produced in the mining and processing of uranium.” And every pound of spent fuel that comes out of the reactor becomes millions of times more radioactive by the time it is taken out.**

**Nuclear Hazards – Extraction. Uranium,** **the metal that commonly fuels nuclear power, is extracted through underground or open-pit mining, or through a chemical process called in situ leaching. Underground uranium mining exposes workers to severe health risks, including lung cancer. Open-pit mining destroys ecosystems, leaving toxic, radioactive remnants and polluted land and water. In** **situ leaching permanently contaminates groundwater.** **Nuclear power is bad for the environment. Thousands of abandoned uranium mines dot the Southwest of the United States, disproportionately in Native American territories and communities of color. These markers of environmental injustice continue to harm the health and well-being of impacted communities and their air, lands, and waters.**

**Nuclear Hazards – Safety and Health**. **Nuclear disasters serve as** prescient **reminders of the** unimaginable **dangers of nuclear power. They may be caused by human error, mechanical failures, and/or natural disasters.** The **Chernobyl** disaster in Ukraine in 1986 **remains the worst nuclear accident in history. It will take at least 3,000 years for the area** surrounding the nuclear power plant **to be habitable**. The second worst nuclear accident occurred **in 2011 after an earthquake and tsunami struck the Fukushima Daiichi Nuclear Power Station in Japan, causing all three operating reactors to melt down.** **The Three Mile Island Generating Station in Pennsylvania experienced a partial meltdown in 1979, leading to increases in cancer and other diseases.** **The worst radiation disaster in U.S. history is the Church Rock uranium spill,** which occurred on **the Navajo Nation** a few months after Three Mile Island. **Nuclear accidents pose extreme threats to life and have forced abandonment of wide swaths of land. Health impacts include increased risk of different types of cancer, immune deficiencies, infant mortality and birth defects, acute radiation syndrome (radiation poisoning), and harms to mental health**. Those who mine and mill uranium and who work at nuclear power plants also **face** **higher risk of** diseases such as **cancer**. The **U.S. nuclear** fleet **is old**, with an average age of 42 years. **Aging infrastructure is more prone to cracks, corrosion, and other compromises in safety.** **Nuclear power stations are also vulnerable to military strikes and threats of terrorism. Further, the technologies required to make nuclear energy are also the technologies required to make nuclear weapons, raising the risk of nuclear proliferation.**

**Nuclear Hazards – Climate Change. Nuclear energy is not a solution to the climate crisis.** Nuclear power is bad for the environment. It is magnitudes **more expensive than wind and solar energy, and magnitudes slower to deploy**. **The long timeline** needed **for nuclear** energy **is** deeply **out of step** **with the urgency of** addressing **the climate crisis.** Resources directed toward nuclear energy are resources that should go to real climate solutions – like solar and wind energy, battery storage, and efficiency. **When measured on a full life cycle basis, nuclear energy is far from a zero emissions technology**. **From mining, milling, and enriching uranium to plant construction, it is an energy intensive process. Further, the impacts of climate change – from warming waters to more extreme weather events like flooding and hurricanes – pose a serious risk to** both **operating and decommissioned nuclear power plants and radioactive waste sites.**

**Nuclear Hazards – Water. Producing nuclear energy is water-intensive, with large volumes consumed in various stages of the process. Climate change is driving heat waves and droughts – which in turn can drive up competition for increasingly scarce water resources, potentially jeopardizing the functioning of nuclear power plants. Nuclear power plants also pollute water and are responsible for killing many billions of fish and other aquatic life every year.**

**Nuclear Power Cost.** Nuclear power is bad for the environment, and **nuclear energy is extremely expensive.** It is **uncompetitive** with other energy sources **without government subsidies**. **Even with** massive **federal subsidies, over 100 reactors have been postponed or cancelled.** **The 17-year construction of two nuclear power reactors at Plant Vogtle in Georgia**— the first nuclear energy project in decades **— took an extra seven years and cost more than twice its $14 billion estimate.** **Subsidies for nuclear energy** have been buried in hundreds of spending bills, with costs **externalized to the environment and future generations and bills literally unpaid, defaulted on, or passed to taxpayers.** Conservative **estimates suggest that** the **nuclear** industry **has received more than $100 billion in subsidies**, and **federal legislation enacted by President Biden has authorized up to another $140 billion in subsidies**, financing, and incentives. **The cost to dispose of nuclear waste is high, and the costs to clean up nuclear disasters are estimated to be in the hundreds of billions.**

#### Nuclear Energy is bad for the economy and climate

Lovins 2021

Lovins, Amory. Adjunct professor of civil and environmental engineering at Stanford University. He has advised major firms and governments in over 70 countries for 49 years. “Why Nuclear Power Is Bad For Your Wallet And The Environment”. Published by Bloomberg Law. December 17, 2021. Available here: (<https://news.bloomberglaw.com/environment-and-energy/why-nuclear-power-is-bad-for-your-wallet-and-the-climate>) - JB

Making 10% of world and 20% of U.S. commercial electricity, nuclear power is historically significant but now stagnant. In 2020, its global capacity additions minus retirements totaled only 0.4 GW (billion watts). Renewables in contrast added 278.3 GW—782x more capacity—able to produce about 232x more annual electricity (based on U.S. 2020 performance by technology). Renewables swelled supply and displaced carbon as much every 38 hours as nuclear did all year. As of early December, 2021’s score looks like nuclear –3 GW, renewables +290 GW. Game over. **The world already invests annually $0.3 trillion each, mostly voluntary private capital, in energy efficiency and renewables, but about $0.015–0.03 trillion, or 20–40x less, in nuclear**—mostly conscripted, **because investors got burned**. **Of 259 US power reactors ordered (1955–2016), only 112 got built and 93 remain operable**; **by mid-2017, just 28 stayed competitive** and suffered no year-plus outage. In the oil business, that’s called an 89% dry-hole risk. **Renewables provided all global electricity growth in 2020. Nuclear power struggles to sustain its miniscule marginal share as its vendors, culture, and prospects shrivel. World reactors average 31 years old, in the U.S., 41.** Within a few years, old and uneconomic reactors’ retirements will consistently eclipse additions, tipping output into permanent decline. World nuclear capacity already fell in five of the past 12 years for a 2% net drop. Performance has become erratic: the average French reactor in 2020 produced nothing one-third of the time.

**Nuclear Power Has No Business Case**. Nuclear power has bleak prospects because it has no business case. **New plants cost 3–8x or 5–13x more per kWh than unsubsidized new solar or windpower, so new nuclear power produces 3–13x fewer kWh per dollar and therefore displaces 3–13x less carbon per dollar than new renewables.** **Thus buying nuclear makes climate change worse**. End-use efficiency is even cheaper than renewables, hence even more climate-effective. **Arithmetic is not an opinion.** **Unsubsidized efficiency or renewables even beat most existing reactors’ operating cost,** **so a dozen have closed over the past decade. Congress is trying to rescue the others with a $6 billion lifeline** and durable, generous new operating subsidies to replace or augment state largesse—**adding to existing federal subsidies that rival or exceed nuclear construction costs.**

#### Small Modular Nuclear Reactors Won’t Help Counter the Climate Crisis

Ramana and Makhijani 2021

M.V, Ramana. Ph.D. in Physics and Simons Chair in Disarmament, Global and Human Security and Director of the Liu Institute for Global Issues at the School of Public Policy and Global Affairs, University of British Columbia, in Vancouver, Canada. Makhijani, Arjun. Ph.D. in Engineering (Nuclear Fusion) and president of the Institute for Energy and Environmental Research. “Why Small Modular Nuclear Reactors Won’t Help Counter the Climate Crisis”. Published in Environmental Working Group. March 25, 2021. Available here: (<https://www.ewg.org/news-insights/news/why-small-modular-nuclear-reactors-wont-help-counter-climate-crisis>) - JB

**There is no realistic prospect that SMRs can make a significant dent in the need to transition rapidly to a carbon-free electricity system.** **The prospects of timely contributions by even the light water designs,** with NuScale being the most advanced in schedule, **are dismal.** The prospects for reactors of other designs, like those with graphite fuels or sodium cooling, are even more so.

**It will be a tough road for SMRs to achieve cost parity with large reactors. And that cost will still be far too high. Two things are in critically short supply on the road to a climate-friendly energy system: time and money.** An objective evaluation indicates that **SMRs are poor on both counts**. **There is simply no realistic prospect for SMRs to play materially significant role in climate change mitigation.**

#### Uranium Mining Bad

Ghosh 2022

Ghosh, Padmaparna. Science writer and communicator based in Cambridge, United Kingdom. She has spent most of her career reporting and writing on environmental themes from climate change to resource rights. “Nuclear Power 101. How it works, how safe it is, and, ultimately, how its costs outweigh its benefits.”. Published by. January 5, 2022. Available here: (<https://www.nrdc.org/stories/nuclear-power-101>) - JB

**Uranium,** the fuel for nuclear power plants**, is generally extracted in one of three ways: underground mining, surface or open-pit mining, or a chemical process called in situ leaching (ISL). Each technique has broad impacts on the human and natural environment.** **Underground mining exposes workers to high levels of radon gas. Studies have found strong evidence for an increased risk of lung cancer in uranium miners due to exposure to this odorless, colorless radioactive gas formed during the natural breakdown of uranium in soil, rocks, and water. Miners are also exposed to the risk of cave-ins and pneumoconiosis, a lung disease caused by inhaling dust. Surface or open-pit mining** is safer for miners than underground mines, but the **process involves blasting 30 times more earth, and the material left over** after processing **is radioactive and toxic. The surrounding land is** also **left with increased erosion, landslides, and polluted soil and water.** [**ISL mining**](https://www.nrdc.org/sites/default/files/uranium-mining-report.pdf)now **accounts for most uranium production in the United States.** Rather than dig uranium straight out of the earth, ISL sends liquid underground to dissolve uranium directly from the underground ore. This solution is then pumped to the surface where the mineral can be recovered. **ISL operations, currently located mainly in Nebraska, Texas, and Wyoming release considerable amounts of radon and produce waste slurries and wastewater during recovery of the uranium from the liquid solution. The most pressing environmental risk associated with ISL,** however, **is the contamination of groundwater. Restoring natural groundwater conditions after completion of leaching operations is virtually impossible and has never been achieved.** Uranium mining in the United States has dropped sharply since its 1980 peak. (Today, Kazakhstan is the biggest uranium miner, followed by Australia and Canada.) But **the southwestern United States is littered with thousands of abandoned uranium mines—presenting serious issues of** [**environmental injustice**](https://www.nrdc.org/experts/geoffrey-h-fettus/goodbye-yucca-its-now-time-consent-nuclear-waste)**.** Just east of Grand Canyon National Park, **in the Navajo Nation, hundreds of abandoned uranium mines remain a threat to the health of communities and the Colorado River ecosystem. Many communities still suffer from environmental contamination, toxic spills, and under-addressed cancer and disease clusters.**