Case

Renewable energy is growing in the US private sector

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 [and] renewables [will] 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.

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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/. 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[ing] 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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Luke **Haywood et. al**, No Publication, 8-16-20**23** // // Why investing in new nuclear plants is bad for the climate // https://www.sciencedirect.com/science/article/pii/S2542435123002817 // accessed 3-28-2025 // ashe

There has been a strong push to promote increased **investments in** new **nuclear power** as a strategy to decarbonize economies, **especially in the** European Union (EU) and the United States (**US). [But] The evidence base for these initiatives is poor**. Investments in **new nuclear** power **plants are bad for the climate due to high costs and long construction times**. **Given the urgency of climate change** mitigation, which requires reducing emissions from the EU electricity grid to almost zero in the 2030s (Pietzcker et al.1), **preference should be given to the cheapest technology that can be deployed fastest**. On both costs and speed, **renewable energy** sources **beat nuclear**. **Every [dollar]** euro **invested in new nuclear plants** thus **delays decarbonization** compared to investments in renewable power. In a decarbonizing world, delays increase CO2 emissions. Our thoughts focus on new nuclear power plants (not phasing out existing plants) in the US and Europe. In Europe, new nuclear power plants are planned or seriously discussed in France, Czechia, Hungary, Poland, Bulgaria, Slovenia, Sweden, and the United Kingdom. We do not focus on China, where government-set electricity prices and subsidized capital costs make it more difficult to contrast the profitability of different types of energy sources.

Thus, our sole argument concerns an environmental tradeoff

Our first point is the climate.

Nuclear energy contributes to climate change in multiple stages of its long development process

Joscha **Weber 21** (Joscha Weber, 11-29-2021, Fact check: Is nuclear energy good for the climate? – DW – 11/29/2021, dw, https://www.dw.com/en/fact-check-is-nuclear-energy-good-for-the-climate/a-59853315, Accessed 3-29-2025, wayway)

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 [and] transported and stored under strict conditions — here, too, emissions must be taken into account.** A nuclear plant cooling tower is being torn down in Mülheim-Kärlich, GermanyA nuclear plant cooling tower is being torn down in Mülheim-Kärlich, Germany Dismantling nuclear power plants — as seen here in Mülheim-Kärlich, Germany — also produces CO2Image: Thomas Frey/dpa/picture alliance 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. Show additional content? This content is part of the text you are currently reading. The provider X / Twitter provides this content and may collect your usage data directly when you click “Show content”. Always show content from X / Twitter. 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. How much CO2 does nuclear power produce? Results vary significantly, depending on whether we only consider the process of electricity generation, or take into account the entire life cycle of a nuclear power plant. A report released in 2014 by the UN's Intergovernmental Panel on Climate Change (IPCC), for example, estimated a range of 3.7 to 110 grams of CO2 equivalent per kilowatt-hour (kWh). It's long been assumed that nuclear plants generate an average of 66 grams of CO2/kWh — though Wealer believes the actual figure is much higher. New power plants, for example, generate more CO2 during construction than those built in previous decades, due to stricter safety regulations. Studies that include the entire life cycle of nuclear power plants, from uranium extraction to nuclear waste storage, are rare, with some researchers pointing out that data is still lacking. In one life cycle study, the Netherlands-based World Information Service on Energy (WISE) calculated that nuclear plants produce 117 grams of CO2 emissions per kilowatt-hour. It should be noted, however, that WISE is an anti-nuclear group, so is not entirely unbiased. Emissions Balance Energy Sources 2020Emissions Balance Energy Sources 2020 **However, other studies have come up with similar results when considering entire life cycles. Mark Z. Jacobson, director of the Atmosphere / Energy Program at California's Stanford University, calculated a climate cost of 68 to 180 grams of CO2/kWh, depending on the electricity mix used in uranium production and other variables. How climate-friendly is nuclear compared to other energies? If the entire life cycle of a nuclear plant is included in the calculation, nuclear energy certainly comes out ahead of fossil fuels like coal or natural gas. But the picture is drastically different when compared with renewable energy. According to new but still unpublished data from the state-run German Environment Agency (UBA) as well as the WISE figures, nuclear power releases 3.5 times more CO2 per kilowatt-hour than photovoltaic solar panel systems. Compared with onshore wind power, that figure jumps to 13 times more CO2. When up against electricity from hydropower installations, nuclear generates 29 times more carbon.**

The aff sacrifices a common sense solution: renewable energy

Enrique **Dans 23** (Enrique Dans, 9-18-2023, Here’s another, often overlooked reason why nuclear energy is a bad thing, Medium, https://medium.com/enrique-dans/heres-another-often-overlooked-reason-why-nuclear-energy-is-a-bad-thing-6522371f5e4f, Accessed 3-29-2025, wayway)

Once commissioned, a nuclear power plant cannot be shut down without incurring enormous costs. This results in a contribution to the energy fabric of a country that is virtually constant, predictable and generally considered to be cheap. In reality, the price assigned to nuclear power is a trap, because it ignores the fact that the "payback time" for a nuclear power plant is between 10 and 18 years, depending on the quality of the uranium ores used as fuel. **This means that a nuclear power plant must operate for at least a decade before all the energy consumed to build and fuel it has been recovered and the plant starts producing net power. That figure that is reduced to [just] one year for [renewables] wind power and less than three for solar power.**

Overall, in the long term

"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.**

On the contrary,

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..

At the end of the day, reducing climate change is key because every degree matters.

Cassella 23 [Carly Cassella, 8-30-2023, "Scientists Warn 1 Billion People on Track to Die From Climate Change," ScienceAlert,

https://www.sciencealert.com/scientists-warn-1-billion-people-on-track-to-die-from-climate-change] //clairec 6

The fossil fuels that humanity burns today will be a death sentence for many lives tomorrow. A recent review of 180 articles on the human death rate of climate change has settled on a deeply distressing number. Over the next century or so, conservative estimates suggest a**billion people could die from climate**catastrophes, possibly more. As with most predictions for the future, this one is based on several assumptions. One is a rough rule of thumb called the '1000-ton rule'. Under this framework,**every thousand tons of carbon that humanity burns is said to indirectly condemn a future person to death.** If the world reaches temperatures 2°C above the average global preindustrial temperature, which is **what we are on track for in the coming decades, then that's a lot of lives lost. 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.

Our second point is waste

Nuclear waste is long-lasting and highly hazardous even in small quantities, while efforts to dispose of it are costly and counterproductive

Martina **Igini 22** (Martina Igini, 9/12/2022, The Nuclear Waste Disposal Dilemma, Earth.Org, https://earth.org/nuclear-waste-disposal/, Accessed 3-29-2025, wayway)

In the nuclear energy equation, the storage and disposal of nuclear waste play a huge role. This comes in two forms: from leftover fuels used in nuclear power plants and from facilities involved in nuclear weapons production. Regardless of the source, this hazardous waste **contains highly poisonous chemicals like plutonium and uranium pellets. These extremely toxic materials remain highly radioactive for tens of thousands of years**, posing a threat to agricultural land, fishing waters, freshwater sources, and humans. For this reason, it is crucial that they are meticulously and permanently disposed of. Two of the world's biggest nuclear accidents – the Fukushima nuclear disaster (2011) and the Chernobyl disaster (1986) – were responsible for the release of a significant amount of radioactive isotopes into the atmosphere, which created huge consequences for people and the environment. These disasters raised concerns about the storage and disposal of nuclear waste and led governments to find safer alternatives to this form of energy. However, in recent years, countries like France, the US, China, and India have shown renewed interest in nuclear power, announcing plans to build new plants in the years ahead as part of their net-zero roadmaps. Take Action Join The Movement Today EARTH.ORG MEMBERSHIP According to Rystad Energy, investments in nuclear are projected to reach US$46 billion in 2023, up from $44 billion in 2021. Furthermore, following the energy crisis amid the conflict in Ukraine, European countries that are highly dependent on Russian oil like Belgium delayed their plans for a nuclear phaseout. While this form of electricity is emission-free and thus a better alternative to highly polluting fossil fuels, the decision of several nations to keep relying on nuclear energy sparked fears related to the dangers of highly radioactive spent fuel. Indeed, while 55 new reactors across the world are currently being built, not enough people are considering the complexity of dismantling plants and storing nuclear

waste. You might also like: The Advantages and Disadvantages of Nuclear Energy How Are Countries Dealing With Nuclear Waste? Since the 1950s, when early commercial nuclear power stations started operating, more than 250,000 tonnes of highly toxic nuclear waste have been accumulated and spread across 14 countries worldwide. **In most cases, the highly radioactive material is collected and stored in inactive nuclear power plants**. In the case of Chernobyl, some of the plant's reactors **still contain an enormous amount of waste that will remain dangerous for tens of thousands of years.** In 2019, one reactor was finally encased below an enormous steel and concrete structure. **However, the US$1.6-billion construction will safely store the radioactive material for only about a century and is thus [which is] just a temporary solution.** Ukraine is not the only country that decided to store nuclear waste in power plants that are no longer operating. The largest quantity of untreated nuclear waste on the planet is currently stored in the Sellafield plant in the UK. **Yet, the maintenance of these sites can be extremely costly and it requires a large amount of manpower.** Despite having shut down in 2003, more than 100,000 employees are involved in ongoing cleanup and nuclear-decommissioning activities at Sellafield that are expected to last more than a century and will cost the government a staggering US$118 billion. While these temporary measures prove to be a safe solution to nuclear waste storage, engineers are now studying ways to dispose of it permanently. You might also like: Nuclear & the Rest: Which is the Safest Energy Source? What About Nuclear Necropolis? The Example of Finland **One of the best solutions so far seems to be to bury nuclear waste underground** and about a dozen European countries have already made plans for deep geological repositories for their spent fuel. However, their plans have hit political roadblocks. **The first and only successful example of this kind to date is Finland's plan to entomb its 2,300 tonnes of high-level waste in an underground hardrock mine. After decades of negotiations, planning, and long geological and environmental considerations, the Finnish government selected the Island of Olkiluoto – located in the municipality of Eurajoki and home to two of the country's four reactors, which generate 32% of the total electricity in the country – as the most suitable location for a long-term storage facility.** In 2004, works began encapsulating waste inside copper canisters, which were buried in 400-450-metre deep underground tunnels below the island's granite bedrock. Now, Finland is close to completing the world's first long-term nuclear waste disposal site, which is expected to be operational in 2023. Despite the government ensuring that its disposal facility – **which cost approximately €2.6 billion (US$3.4 billion**) – is "final", **doubts remain this can truly be a long-term solution. [b]ecause nothing of this kind has ever been built before in human history, Finland's project does not come without huge technical uncertainties and unpredictable factors** that could compromise a facility that authorities hope will store nuclear waste for at least 100,000 years. If something were to go wrong, future generations could risk immense widespread pollution. A Future Outlook on Nuclear Waste Disposal Despite a growing number of countries around the world making plans to shift toward renewable energies in the race to meet their net-zero targets in the coming decades, not all governments are ready to abandon nuclear energy altogether, with many delaying the nuclear phaseout or even building new plants. An issue associated with this type of energy is the disposal and storage of highly radioactive leftover fuel. It is undeniable that significant progress in the safe and effective management of toxic materials has been made in recent years. However, no country in the world has yet come up with a reliable permanent solution to store nuclear waste. While Finland's repository might be the world's first-ever successful long-term storage facility, doubts remain that it will last that long. Furthermore, the extremely high costs associated with building the underground site as well as the potentially destructive consequences that the local community and the surrounding environment will face should something go wrong are not worth the risk. **Instead of relying on a potentially destructive energy source like nuclear power, countries should put more effort into shifting to renewables.**

Additionally, nuclear power is inefficient while disposing of many forms of waste into our air and water

Wasserman '21 finds – wrote The People's Spiral of U.S. History. (Harvey, "How Nuclear Power Causes Global Warming," Progressive.org, 9-21-2016, https://progressive.org/latest/nuclear-power-causes-global-warming/, Accessed 7-25-2021, LASA-SC)

Every nuclear generating station spews about **two-thirds of the energy it burns inside** its reactor core **into the environment. Only one-third is converted into electricity**. Another tenth of that is lost in transmission. According to the Union of Concerned Scientists: **Nuclear fission is the most water intensive method of the**

principal thermoelectric generation options in terms of the amount of water withdrawn from sources. In 2008, nuclear power plants withdrew eight times as much freshwater as natural gas plants per unit of energy produced, and up to 11 percent more than the average coal plant. **Every day, large reactors** like the two at Diablo Canyon, California, individually **dump** about **1.25 billion gallons of water into the ocean** at temperatures **up to 20 degrees Fahrenheit warmer than the natural environment.** Diablo's "once-through **cooling system" takes water out** of the ocean **and dumps it back superheated, irradiated and laden with toxic chemicals. Many U.S. reactors use cooling towers which emit huge quantities of steam and water vapor that also directly warm the atmosphere. These emissions are often chemically treated to prevent algae and other growth that could clog the towers. Those chemicals can then be carried downwind, along with radiation from the reactors.** In addition, **hundreds of thousands of birds die annually by flying into the reactor domes** and towers. The Union of Concerned Scientists states: The **temperature increase in the bodies of water can have serious adverse effects on aquatic life. Warm water holds less oxygen than cold water, thus discharge from once-through cooling systems can create a "temperature squeeze" that elevates the metabolic rate for fish.** Additionally, **suction pipes that are used to intake water can draw plankton, eggs and larvae into the plant's machinery, while larger organisms can be trapped against the protective screens of the pipes. Blocked intake screens have led to temporary shut downs and NRC fines at a number of plants.** And that's not all. All nuclear **reactors emit Carbon 14, a radioactive isotope, invalidating the industry's claim that reactors are "carbon free." And the fuel that reactors burn is carbon-intensive.** The **mining, milling, and enrichment processes needed to produce the pellets that fill the fuel rods inside the reactor cores all involve major energy expenditures, nearly all of it based on coal, oil, or gas.**

Renewable energy produces waste that is less hazardous, more recyclable, and economically beneficial

Dianne **Plummer 25** (Dianne Plummer, 2-11-2025, Nuclear Vs. Renewables: Which Energy Source Wins The Zero-Carbon Race?, Forbes, https://www.forbes.com/sites/dianneplummer/2025/02/11/nuclear-vs-renewables-which-energy-source-wins-the-zero-carbon-race/, Accessed 3-29-2025, wayway)

On the other hand, solar panels and batteries face end-of-life disposal challenges. The rapid expansion of solar photovoltaic technology since the early 2000s has positioned it as a cornerstone of the clean energy revolution, but it also presents a looming environmental challenge: end-of-life waste. By the early 2030s, millions of decommissioned solar panels will contribute to a growing global waste stream, yet this challenge carries immense economic potential. According to the International Renewable Energy Agency and the IEA Photovoltaic Power Systems Program, **properly managed PV waste could yield 78 million tons of recoverable raw materials by 2050, valued at over $15 billion.** Establishing recycling and repurposing industries will be critical to mitigating environmental risks while maximizing resource efficiency. However, this requires forward-thinking policy frameworks, strategic investment, and a commitment to integrating circular economy principles into the renewable energy sector. **However, initiatives like First Solar's closed-loop recycling are reducing environmental impacts, making solar [renewables] more recyclable than nuclear fuel.**

The health effects are tremendous

Cindy **Folkers** 1, ✉, Linda Pentz Gunter 1 **22** (Cindy Folkers 1, ✉, Linda Pentz Gunter 1, 10-7-2022, Radioactive releases from the nuclear power sector and implications for child health, PubMed Central (PMC), https://pmc.ncbi.nlm.nih.gov/articles/PMC9557777/, Accessed 3-29-2025, wayway)

Nuclear power plants routinely release radioactivity as part of daily operation. In 2008, a landmark case-control study was published in Germany,43 known as the KiKK study. **It revealed an unsettling 1.6-fold increase in all cancers and a 2.2-fold increase in leukaemias among children under 5 years old living within 5 km of operating nuclear power plants.** In general, the incidences were higher the closer the children lived to the nuclear plant. The KiKK findings were backed up by other studies44 and a meta-analysis.45

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energies? If the entire life cycle of a nuclear plant is included in the calculation, nuclear energy certainly comes out ahead of fossil fuels like coal or natural gas. But the picture is drastically different when compared with renewable energy. According to new but still unpublished data from the state-run German Environment Agency (UBA) as well as the WISE figures, nuclear power releases 3.5 times more CO2 per kilowatt-hour than photovoltaic solar panel systems. Compared with onshore wind power, that figure jumps to 13 times more CO2. When up against electricity from hydropower installations, nuclear generates 29 times more carbon.

The aff sacrifices a common sense solution: renewable energy

Enrique **Dans 23** (Enrique Dans, 9-18-2023, Here's another, often overlooked reason why nuclear energy is a bad thing, Medium, https://medium.com/enrique-dans/heres-another-often-overlooked-reason-why-nuclear-energy-is-a-bad-thing-6522371f5e4f, Accessed 3-29-2025, wayway)

Once commissioned, a nuclear power plant cannot be shut down without incurring enormous costs. This results in a contribution to the energy fabric of a country that is virtually constant, predictable and generally considered to be cheap. In reality, the price assigned to nuclear power is a trap, because it ignores the fact that the "payback time" for a nuclear power plant is between 10 and 18 years, depending on the quality of the uranium ores used as fuel. **This means that a nuclear power plant must operate for at least a decade before all the energy consumed to build and fuel it has been recovered and the plant starts producing net power. That figure that is reduced to [just] one year for [renewables] wind power and less than three for solar power.**

Overall, in the long term

"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.**

On the contrary,

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..

At the end of the day, reducing climate change is key because every degree matters.

Cassella 23 [Carly Cassella, 8-30-2023, "Scientists Warn 1 Billion People on Track to Die From Climate Change," ScienceAlert, https://www.sciencealert.com/scientists-warn-1-billion-people-on-track-to-die-from-climate-change] //clairec 6

The fossil fuels that humanity burns today will be a death sentence for many lives tomorrow. A recent review of 180 articles on the human death rate of climate change has settled on a deeply distressing number. Over the next century or so, conservative estimates suggest a**billion people could die from climate**catastrophes, possibly more. As with most predictions for the future, this one is based on several assumptions. One is a rough rule of thumb called the '1000-ton rule'. Under this framework,**every thousand tons of carbon that humanity burns is said to indirectly condemn a future person to death.** If the world reaches temperatures 2°C above the average global preindustrial temperature, which is **what we are on track for in the coming decades, then that's a lot of lives lost. 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.

Our second point is waste

Nuclear waste is long-lasting and highly hazardous even in small quantities, while efforts to dispose of it are costly and counterproductive

Martina **Igini 22** (Martina Igini, 9/12/2022, The Nuclear Waste Disposal Dilemma, Earth.Org, https://earth.org/nuclear-waste-disposal/, Accessed 3-29-2025, wayway)

In the nuclear energy equation, the storage and disposal of nuclear waste play a huge role. This comes in two forms: from leftover fuels used in nuclear power plants and from facilities involved in nuclear weapons production. Regardless of the source, this hazardous waste **contains highly poisonous chemicals like plutonium and uranium pellets. These extremely toxic materials remain highly radioactive for tens of thousands of years**, posing a threat to agricultural land, fishing waters, freshwater sources, and humans. For this reason, it is crucial that they are meticulously and permanently disposed of. Two of the world's biggest nuclear accidents – the Fukushima nuclear disaster (2011) and the Chernobyl disaster (1986) – were responsible for the release of a significant amount of radioactive isotopes into the atmosphere, which created huge consequences for people and the environment. These disasters raised concerns about the storage and disposal of nuclear waste and led governments to find safer alternatives to this form of energy. However, in recent years, countries like France, the US, China, and India have shown renewed interest in nuclear power, announcing plans to build new plants in the years ahead as part of their net-zero roadmaps. Take Action Join The Movement Today EARTH.ORG MEMBERSHIP According to Rystad Energy, investments in nuclear are projected to reach US$46 billion in 2023, up from $44 billion in 2021. Furthermore, following the energy crisis amid the conflict in Ukraine, European countries that are highly dependent on Russian oil like Belgium delayed their plans for a nuclear phaseout. While this form of electricity is emission-free and thus a better alternative to highly polluting fossil fuels, the decision of several nations to keep relying on nuclear energy sparked fears related to the dangers of highly radioactive spent fuel. Indeed, while 55 new reactors across the world are currently being built, not enough people are considering the complexity of dismantling plants and storing nuclear waste. You might also like: The Advantages and Disadvantages of Nuclear Energy How Are Countries Dealing With Nuclear Waste? Since the 1950s, when early commercial nuclear power stations started operating, more than 250,000 tonnes of highly toxic nuclear waste have been accumulated and spread across 14 countries worldwide. **In most cases, the highly radioactive material is collected and stored in inactive nuclear power plants**. In the case of Chernobyl, some of the plant's reactors **still contain an enormous amount of waste that will remain dangerous for tens of thousands of years.** In 2019, one reactor was finally encased below an enormous steel and concrete structure. **However, the US$1.6-billion construction will safely store the radioactive material for only about a century and is thus [which is] just a temporary solution.** Ukraine is not the only country that decided to store nuclear waste in power plants that are no longer operating. The largest quantity of untreated nuclear waste on the planet is currently stored in the Sellafield plant in the UK. **Yet, the maintenance of these sites can be extremely costly and it requires a large amount of manpower.** Despite having shut down in 2003, more than 100,000 employees are involved in ongoing cleanup and nuclear-decommissioning activities at Sellafield that are expected to last more than a century and will cost the government a staggering US$118 billion. While these temporary measures prove to be a safe solution to nuclear waste storage, engineers are now studying ways to dispose of it permanently. You might also like: Nuclear & the Rest: Which is the Safest Energy Source? What About Nuclear Necropolis? The Example of Finland **One of the best solutions so far seems to be to bury nuclear waste underground** and about a dozen European countries have already made plans for deep geological repositories for their spent fuel. However, their plans have hit political roadblocks. **The first and only successful example of this kind to date is Finland's plan to entomb its 2,300 tonnes of high-level waste in an underground hardrock mine. After decades of negotiations, planning, and long geological and environmental considerations, the Finnish government selected the Island of Olkiluoto – located in the municipality of Eurajoki and home to two of the country's four reactors, which generate 32% of the total electricity in the country – as the most suitable location for a long-term storage facility.** In 2004, works began encapsulating waste inside copper canisters, which were buried in 400-450-metre deep underground tunnels below the island's granite bedrock. Now, Finland is close to completing the world's first long-term nuclear waste disposal site, which is expected to be operational in 2023. Despite the government ensuring that its disposal facility – **which cost approximately €2.6 billion (US$3.4 billion)** – is "final", **doubts remain this can truly be a long-term solution. [b]ecause nothing of this kind has ever been built before in human history, Finland's project does not come without huge technical uncertainties and unpredictable factors** that could compromise a facility that authorities hope will store nuclear waste for at least 100,000 years. If something were to go wrong, future generations could risk immense

widespread pollution. A Future Outlook on Nuclear Waste Disposal Despite a growing number of countries around the world making plans to shift toward renewable energies in the race to meet their net-zero targets in the coming decades, not all governments are ready to abandon nuclear energy altogether, with many delaying the nuclear phaseout or even building new plants. An issue associated with this type of energy is the disposal and storage of highly radioactive leftover fuel. It is undeniable that significant progress in the safe and effective management of toxic materials has been made in recent years. However, no country in the world has yet come up with a reliable permanent solution to store nuclear waste. While Finland's repository might be the world's first-ever successful long-term storage facility, doubts remain that it will last that long. Furthermore, the extremely high costs associated with building the underground site as well as the potentially destructive consequences that the local community and the surrounding environment will face should something go wrong are not worth the risk. **Instead of relying on a potentially destructive energy source like nuclear power, countries should put more effort into shifting to renewables.**

Additionally, nuclear power is inefficient while disposing of many forms of waste into our air and water

Wasserman '21 finds – wrote The People's Spiral of U.S. History. (Harvey, "How Nuclear Power Causes Global Warming," Progressive.org, 9-21-2016, https://progressive.org/latest/nuclear-power-causes-global-warming/, Accessed 7-25-2021, LASA-SC)

Every nuclear generating station spews about **two-thirds of the energy it burns inside** its reactor core **into the environment. Only one-third is converted into electricity**. Another tenth of that is lost in transmission. According to the Union of Concerned Scientists: **Nuclear fission is the most water intensive method of the principal thermoelectric generation** options in terms of the amount of water withdrawn from sources. In 2008, nuclear power plants withdrew eight times as much freshwater as natural gas plants per unit of energy produced, and up to 11 percent more than the average coal plant. **Every day, large reactors** like the two at Diablo Canyon, California, individually **dump** about **1.25 billion gallons of water into the ocean** at temperatures **up to 20 degrees Fahrenheit warmer than the natural environment.** Diablo's "once-through **cooling system" takes water out** of the ocean **and dumps it back superheated, irradiated and laden with toxic chemicals. Many U.S. reactors use cooling towers which emit huge quantities of steam and water vapor that also directly warm the atmosphere. These emissions are often chemically treated to prevent algae and other growth that could clog the towers. Those chemicals can then be carried downwind, along with radiation from the reactors**. In addition, **hundreds of thousands of birds die annually by flying into the reactor domes** and towers. The Union of Concerned Scientists states: The **temperature increase in the bodies of water can have serious adverse effects on aquatic life. Warm water holds less oxygen than cold water, thus discharge from once-through cooling systems can create a "temperature squeeze" that elevates the metabolic rate for fish**. Additionally, **suction pipes that are used to intake water can draw plankton, eggs and larvae into the plant's machinery, while larger organisms can be trapped against the protective screens of the pipes. Blocked intake screens have led to temporary shut downs and NRC fines at a number of plants.** And that's not all. All nuclear **reactors emit Carbon 14, a radioactive isotope, invalidating the industry's claim that reactors are "carbon free." And the fuel that reactors burn is carbon-intensive.** The **mining, milling, and enrichment processes needed to produce the pellets that fill the fuel rods inside the reactor cores all involve major energy expenditures, nearly all of it based on coal, oil, or gas.**

Renewable energy produces waste that is less hazardous, more recyclable, and economically beneficial

Dianne **Plummer 25** (Dianne Plummer, 2-11-2025, Nuclear Vs. Renewables: Which Energy Source Wins The Zero-Carbon Race?, Forbes, https://www.forbes.com/sites/dianneplummer/2025/02/11/nuclear-vs-renewables-which-energy-source-wins-the-zero-carbon-race/, Accessed 3-29-2025, wayway)

On the other hand, solar panels and batteries face end-of-life disposal challenges. The rapid expansion of solar photovoltaic technology since the early 2000s has positioned it as a cornerstone of the clean energy revolution, but it also presents a looming environmental challenge: end-of-life waste. By the early 2030s, millions of decommissioned solar panels will contribute to a growing global waste stream, yet this challenge carries immense economic potential. According to the International Renewable Energy Agency and the IEA Photovoltaic Power Systems Program, **properly managed PV waste could yield 78 million tons of recoverable raw materials by 2050, valued at over $15 billion.** Establishing recycling and repurposing industries will be critical to mitigating environmental risks while maximizing resource efficiency. However, this requires forward-thinking policy frameworks, strategic investment, and a commitment to integrating circular economy principles into the renewable energy sector. **However, initiatives like First Solar's closed-loop recycling are reducing environmental impacts, making solar [renewables] more recyclable than nuclear fuel.**

The health effects are tremendous

Cindy **Folkers** 1,✉, Linda Pentz Gunter 1 **22** (Cindy Folkers 1,✉, Linda Pentz Gunter 1, 10-7-2022, Radioactive releases from the nuclear power sector and implications for child health, PubMed Central (PMC), https://pmc.ncbi.nlm.nih.gov/articles/PMC9557777/, Accessed 3-29-2025, wayway)

Nuclear power plants routinely release radioactivity as part of daily operation. In 2008, a landmark case-control study was published in Germany,43 known as the KiKK study. **It revealed an unsettling 1.6-fold increase in all cancers and a 2.2-fold increase in leukaemias among children under 5 years old living within 5 km of operating nuclear power plants.** In general, the incidences were higher the closer the children lived to the nuclear plant. The KiKK findings were backed up by other studies44 and a meta-analysis.45

Rebuttal

Rebuttal

"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.**

First, on their case as a whole:**Nuclear can't be revived in U.S.—Take 10 years to build, cost 10s of billions, all while renewables are cheap and efficient**

Hockenos 22 (Paul Hockenos is a Berlin-based writer, wrote the first book on Central Europe's far right, in 1993. His most recent book is Berlin Calling: A Story of Anarchy, Music, the Wall and the Birth of the New Berlin.; 10-13-2022; "Nuclear Power Is a Dead End. We Must Abandon It Completely."; Nation; doα: 9-6-2024) https://www.thenation.com/article/world/nuclear-power-europe-energy/

Nuclear energy is such a colossal expense—into the **tens of billions of dollars**, like the $30 billion Vogtle units in Waynesboro, Ga.—that few private investors will touch them, even with prodigious government OBbankrolling. The UK government finally found a taker for its Hinkley Point C station in 2016 when it offered lavish subsidies to the French energy firm EDF. But even that deal becomes less sweet the higher **construction costs spiral** and the longer EDF postpones its opening beyond 2025. So catastrophic are the cost overruns of EDF's projects worldwide that the company could no longer service its €43 billion debt and this year agreed to full nationalization. But experts say this alone won't solve any of the fundamental problems at Hinkley C or the Flamanville plant in Normandy, which is 10 years behind schedule, with costs fives times in excess of the original budget. Cost overruns are one reason that **one in eight** new reactor projects that start construction are **abandoned**.

While safety concerns drive up the cost of nuclear plant insurance, the price of renewables is predicted **to sink by 50 percent** or more by 2030. Study after study attests that wind and solar cost a fraction of the price of nuclear power: at least three to **eight times the bang for the buck** in terms of energy generation and climate protection, at a time when the exorbitant cost of energy is causing recessions and street protests across Europe. It is because solar photovoltaic and wind power are the cheapest bulk power source in most of the world that renewables, grids, and storage now account for more than 80 percent of power sector investment. In 2021, companies, governments, and households invested 15 times as much in renewable energy than in nuclear. They're simply the better buy.

Ov

On their point about emissions:

In general, nuclear energy is more expensive than renewable energy sources like solar and wind, primarily due to high upfront capital costs and the complexity of nuclear power plants, although nuclear power plants can operate reliably for decades.

They themselves admit fossil fuels root cause: but renewables solve, not

the timeframe doesn't work out:

Nuclear Energy is terrible for the climate

Z. Jacobson 24 [Mark Z. Jacobson, "7 reasons why nuclear energy is not the answer to solve climate change", 10/10/2024, One Earth, https://www.oneearth.org/the-7-reasons-why-nuclear-energy-is-not-the-answer-to-solve-climate-change/, Accessed 04/02/2025] //IA

There is a small group of scientists that have proposed replacing 100% of the world's fossil fuel power plants with nuclear reactors as a way to solve climate change. Many others propose nuclear grow to satisfy up to 20 percent of all our energy (not just electricity) needs. They advocate that nuclear is a "clean" carbon-free source of power, but they don't look at the human impacts of these scenarios. Let's do the math... **One nuclear power plant takes on average about 14-1/2 years to build**, from the planning phase all the way to operation. According to the World Health Organization, about 7.1 million people die from air pollution each year, with more than 90 percent of these deaths from energy-related combustion. So s**witching out our energy system to nuclear would result in about 93 million people dying, as we wait for all the new nuclear plants to be built** in the all-nuclear scenario. Utility-scale **wind and solar farms, on the other hand, take on average only two to five years**, from the planning phase to operation. Rooftop solar PV projects are down to only a 6-month timeline. So transitioning to 100% renewables as soon as possible would result in tens of millions fewer deaths. This illustrates a major problem with nuclear power and why renewable energy -- in particular Wind, Water, and Solar (WWS) -- avoids this problem. Nuclear, though, doesn't just have one problem. It has seven. Here are the seven major problems with nuclear energy: Cofrentes Nuclear Power Plant located about two kilometers southeast of Cofrentes, Spain. Image credit: Roberto Uderio, CC BY SA-3.0 1. Long Time Lag Between Planning and Operation The time lag between planning and operation of a nuclear reactor includes the times to identify a site, obtain a site permit, purchase or lease the land, obtain a construction permit, obtain financing and insurance for construction, install transmission, negotiate a power purchase agreement, obtain permits, build the plant, connect it to transmission, and obtain a final operating license. The planning-to-operation (PTO) times of all nuclear plants ever built have been 10-19 years or more. For example, the Olkiluoto 3 reactor in Finland was proposed to the Finnish cabinet in December 2000 to be added to an existing nuclear power plant. Its latest estimated completion date is 2020, giving it a PTO time of 20 years. The Hinkley Point nuclear plant was planned to start in 2008. It has an estimated the completion year of 2025 to 2027, giving it a PTO time of 17 to 19 years. The Vogtle 3 and 4 reactors in Georgia were first proposed in August 2006 to be added to an existing site. The anticipated completion dates are November 2021 and November 2022, respectively, given them PTO times of 15 and 16 years, respectively. The Haiyang 1 and 2 reactors in China were planned to start in 2005. Haiyang 1 began commercial operation on October 22, 2018. Haiyang 2 began operation on January 9, 2019, giving them PTO times of 13 and 14 years, respectively. The Taishan 1 and 2 reactors in China were bid in 2006. Taishan 1 began commercial operation on December 13, 2018. Taishan 2 is not expected to be connected until 2019, giving them PTO times of 12 and 13 years, respectively. Planning and procurement for four reactors in Ringhals, Sweden started in 1965. One took 10 years, the second took 11 years, the third took 16 years, and the fourth took 18 years to complete. Many claim that France's 1974 Messmer plan resulted in the building of its 58 reactors in 15 years. This is not true. The planning for several of these nuclear reactors began long before. For example, the Fessenheim reactor obtained its construction permit in 1967 and was planned starting years before. In addition, 10 of the reactors were completed between 1991-2000. As such, the whole planning-to-operation time for these reactors was at least 32 years, not 15. That of any individual reactor was 10 to 19 years. Radiation hotspot in Kashiwa, Japan | Public Domain 2. Cost The levelized cost of energy (LCOE) for a new nuclear plant in 2018, based on Lazard, is $151 (112 to 189)/MWh. This compares with $43 (29 to 56)/MWh for onshore wind and $41 (36 to 46)/MWh for utility-scale solar PV from the same source. This nuclear LCOE is an underestimate for several reasons. First, Lazard assumes a construction time for nuclear of 5.75 years. However, the Vogtle 3 and 4 reactors, though will take at least 8.5 to 9 years to finish construction. This additional delay alone results in an estimated LCOE for nuclear of about $172 (128 to 215)/MWh, or a cost 2.3 to 7.4 times that of an onshore wind farm (or utility PV farm). Next, the LCOE does not include the cost of the major nuclear meltdowns in history. For example, the estimated cost to clean up the damage from three Fukushima Dai-ichi nuclear reactor core meltdowns was $460 to $640 billion. This is $1.2 billion, or 10 to 18.5 percent of the capital cost, of every nuclear reactor worldwide. In addition, the LCOE does not include the cost of storing nuclear waste for hundreds of thousands of years. In the U.S. alone, about $500 million is spent yearly to safeguard nuclear waste from about 100 civilian nuclear energy plants. This amount will only increase as waste continues to accumulate. After the plants retire, the spending must continue for hundreds of thousands of years with no revenue stream from electricity sales to pay for the storage. Nuclear missiles with warhead aimed at the skies. Image credit: © Victority | Dreamstime 3. Weapons Proliferation Risk The growth of nuclear energy has historically increased the ability of nations to obtain or harvest plutonium or enrich uranium to manufacture nuclear weapons. The Intergovernmental Panel on Climate Change (IPCC) recognizes this fact. They concluded in the Executive Summary of their 2014 report on energy, with "robust evidence and high agreement" that nuclear weapons proliferation concern is a barrier and risk to the increasing development of nuclear energy: Barriers to and risks associated with an increasing use of nuclear energy include operational risks and the associated safety concerns, uranium mining risks, financial and regulatory risks, unresolved waste management issues, nuclear weapons proliferation concerns, and adverse public opinion. The building of a nuclear reactor for energy in a country that does not currently have a reactor allows the country to import uranium for use in the nuclear energy facility. If the country so chooses, it can secretly enrich the uranium to create weapons-grade uranium and harvest plutonium from uranium fuel rods for use in nuclear weapons. This does not mean any or every country will do this, but historically some have and the risk is high, as noted by IPCC. The building and spreading of Small Modular Reactors (SMRs) may increase this risk further. Gundremmingen Nuclear Power Plant in Germany. Image credit: Felix König, CC BY-SA 3.0 4. Meltdown Risk To date, 1.5 percent of all nuclear power plants ever built have melted down to some degree. Meltdowns have been either catastrophic (Chernobyl, Ukraine in 1986; three reactors at Fukushima Dai-ichi, Japan in 2011) or damaging (Three-Mile Island in 1979; Saint-Laurent France in 1980). The nuclear industry has proposed new reactor designs that they suggest are safer. However, these designs are generally untested, and there is no guarantee that the reactors will be designed, built, and operated correctly or that a natural disaster or act of terrorism, such as an airplane flown into a reactor, will not cause the reactor to fail, resulting in a major disaster. The Chernobyl reactor #4 building as of 2006, including the later-built

sarcophagus and elements of the maximum-security perimeter. Image credit: Carl Montgomery, CC BY 2.0 5. Mining Lung Cancer Risk Uranium mining causes lung cancer in large numbers of miners because uranium mines contain natural radon gas, some of whose decay products are carcinogenic. A study of 4,000 uranium miners between 1950 and 2000 found that 405 (10 percent) died of lung cancer, a rate six times that expected based on smoking rates alone. 61 others died of mining-related lung diseases. Clean, renewable energy does not have this risk because (a) it does not require the continuous mining of any material, only one-time mining to produce the energy generators; and (b) the mining does not carry the same lung cancer risk that uranium mining does. Old derelict uranium quarry in Russia | Shutterstock 6. Carbon-Equivalent Emissions and Air Pollution There is no such thing as a zero- or close-to-zero emission nuclear power plant. Even existing **plants emit due to the continuous mining and refining of uranium needed for the plant.** Emissions from new nuclear are 78 to 178 g-CO2/kWh, not close to 0. Of this, 64 to 102 g-CO2/kWh over 100 years are e**missions from the background grid while consumers wait 10 to 19 years for nuclear to come online or be refurbished,** relative to 2 to 5 years for wind or solar. In addition, all nuclear plants emit 4.4 g-CO2e/kWh from the water vapor and heat they release. This contrasts with solar panels and wind turbines, which reduce heat or water vapor fluxes to the air by about 2.2 g-CO2e/kWh for a net difference from this factor alone of 6.6 g-CO2e/kWh. In fact, **China's investment in nuclear plants that take so long between planning and operation instead of wind or solar resulted in China's CO2 emissions increasing 1.3 percent** from 2016 to 2017 rather than declining by an estimated average of 3 percent. **The resulting difference in air pollution emissions may have caused 69,000 additional air pollution deaths** in China in 2016 a lone, with additional deaths in years prior and since.

Nuclear energy contributes to climate change more than renewables

Joscha **Weber 21** (Joscha Weber, 11-29-2021, Fact check: Is nuclear energy good for the climate? – DW – 11/29/2021, dw, https://www.dw.com/en/fact-check-is-nuclear-energy-good-for-the-climate/a-59853315, Accessed 3-29-2025, wayway)

data from the state-run German Environment Agency (UBA) as well as the WISE figures, nuclear power releases 3.5 times more CO2 per kilowatt-hour than photovoltaic solar panel systems. Compared with onshore wind power, that figure jumps to 13 times more CO2. When up against electricity from hydropower installations, nuclear generates 29 times more carbon.

Nuclear energy fails--- it increases emissions, chances of prolif, and health risks

Jacobson 21, [Mark Z. Jacobson, Professor of Civil and Environmental Engineering & Director, Atmosphere/Energy Program, Stanford University, "The 7 reasons why nuclear energy is not the answer to solve climate change," April 26, 2021, https://eu.boell.org/en/2021/04/26/7-reasons-why-nuclear-energy-not-answer-solve-climate-change]// KAK

There is a small group of scientists that have proposed replacing 100% of the world's fossil fuel power plants with nuclear reactors as a way to solve climate change. Many others propose nuclear grow to satisfy up to 20 percent of all our energy (not just electricity) needs. They advocate that nuclear is a "clean" carbon-free source of power, but they don't look at the human impacts of these scenarios. Let's do the math...

One nuclear power plant takes on average about **14-1/2 years to build**, from the planning phase all the way to operation. According to the World Health Organization, about 7.1 million people die from air pollution each year, with more than 90% of these deaths from energy-related combustion. So switching out our energy system to nuclear would result in about **93 million people dying**, as we wait for all the new nuclear plants to be built in the all-nuclear scenario.

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This illustrates a major problem with nuclear power and why renewable energy -- in particular Wind, Water, and Solar (WWS)-- avoids this problem. Nuclear, though, doesn't just have one problem. It has seven. Here are the seven major problems with nuclear energy

1. Long Time Lag Between Planning and Operation

The time lag between planning and operation of a nuclear reactor includes the times to identify a site, obtain a site permit, purchase or lease the land, obtain a construction permit, obtain financing and insurance for construction, install transmission, negotiate a power purchase agreement, obtain permits, build the plant, connect it to transmission, and obtain a final operating license.

The planning-to-operation (PTO) times of all nuclear plants ever built have been 10-19 years or more. For example, the Olkiluoto 3 reactor in Finland was proposed to the Finnish cabinet in December 2000 to be added to an existing nuclear power plant. Its latest estimated completion date is 2020, giving it a PTO time of 20 years.

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Many claim that France's 1974 Messmer plan resulted in the building of its 58 reactors in 15 years. This is not true. The planning for several of these nuclear reactors began long before. For example, the Fessenheim reactor obtained its construction permit in 1967 and was planned starting years before. In addition, 10 of the reactors were completed between 1991-2000. As such, the whole planning-to-operation time for these reactors was at least 32 years, not 15. That of any individual reactor was 10 to 19 years.

2. Cost

The levelized cost of energy (LCOE) for a new nuclear plant in 2018, based on Lazard, is $151 (112 to 189)/MWh. This compares with $43 (29 to 56)/MWh for onshore wind and $41 (36 to 46)/MWh for utility-scale solar PV from the same source.

This nuclear LCOE is an underestimate for several reasons. First, Lazard assumes a construction time for nuclear of 5.75 years. However, the Vogtle 3 and 4 reactors, though will take at least 8.5 to 9 years to

finish construction. This additional delay alone results in an estimated LCOE for nuclear of about $172 (128 to 215)/MWh, or a cost 2.3 to 7.4 times that of an onshore wind farm (or utility PV farm).

Next, the LCOE does not include the cost of the major nuclear meltdowns in history. For example, the estimated cost to clean up the damage from three Fukushima Dai-ichi nuclear reactor core meltdowns was $460 to $640 billion. This is $1.2 billion, or 10 to 18.5 percent of the capital cost, of every nuclear reactor worldwide.

In addition, the LCOE does not include the cost of storing nuclear waste for hundreds of thousands of years. In the U.S. alone, about $500 million is spent yearly to safeguard nuclear waste from about 100 civilian nuclear energy plants. This amount will only increase as waste continues to accumulate. After the plants retire, the spending must continue for hundreds of thousands of years with no revenue stream from electricity sales to pay for the storage.

3. Weapons Proliferation Risk

The growth of nuclear energy has **historically increased** the ability of nations to **obtain** or harvest **plutonium** or enrich uranium to manufacture nuclear weapons. The Intergovernmental Panel on Climate Change (IPCC) recognizes this fact. They concluded in the Executive Summary of their 2014 report on energy, with **"robust evidence and high agreement**" that nuclear weapons proliferation concern is a barrier and risk to the increasing development of nuclear energy:

Barriers to and risks associated with an increasing use of nuclear energy include operational risks and the associated **safety concerns**, uranium **mining risks,** financial and regulatory risks, unresolved waste management issues, nuclear weapons proliferation concerns, and **adverse public opinion**.

The building of a nuclear reactor for energy in a country that does not currently have a reactor allows the country to **import uranium** for use in the nuclear energy facility. If the country so chooses, it can secretly enrich the uranium to create weapons grade uranium and harvest plutonium from uranium fuel rods for use in nuclear weapons. This does not mean any or every country will do this, but historically some have and the risk is high, as noted by IPCC. The building and spreading of Small Modular Reactors (**SMRs**) may increase this risk further.

4. Meltdown Risk

To date, 1.5% of all nuclear power plants ever built have **melted down** to some degree. Meltdowns have been either **catastrophic** (Chernobyl, Russia in 1986; three reactors at Fukushima Dai-ichi, Japan in 2011) or damaging (Three-Mile Island, Pennsylvania in 1979; Saint-Laurent France in 1980). The nuclear industry has proposed new reactor designs that they suggest are safer. However, these designs are generally **untested**, and there is **no guarantee** that the reactors will be designed, built and operated correctly or that a **natural disaster** or act of **terrorism**, such as an airplane flown into a reactor, will not cause the reactor to fail, resulting in a major disaster.

5. Mining Lung Cancer Risk

Uranium mining causes lung cancer in large numbers of miners because uranium mines contain natural radon gas, some of whose decay products are carcinogenic. A study of 4,000 uranium miners between 1950 and 2000 found that 405 (10 percent) died of lung cancer, a rate six times that expected based on smoking rates alone. 61 others died of mining related lung diseases. Clean, renewable energy does not

have this risk because (a) it does not require the continuous mining of any material, only one-time mining to produce the energy generators; and (b) the mining does not carry the same lung cancer risk that uranium mining does.

6. Carbon-Equivalent Emissions and Air Pollution

There is **no such thing** as a **zero- or close-to-zero emission nuclear** power plant. Even existing plants emit due to the continuous mining and refining of uranium needed for the plant. Emissions from new nuclear are 78 to 178 g-CO2/kWh, not close to 0. Of this, 64 to 102 g-CO2/kWh over 100 years are emissions from the background grid while consumers wait 10 to 19 years for nuclear to come online or be refurbished, relative to 2 to 5 years for wind or solar. In addition, all nuclear plants emit 4.4 g-CO2e/kWh from the water vapor and heat they release. This contrasts with solar panels and wind turbines, which reduce heat or water vapor fluxes to the air by about 2.2 g-CO2e/kWh for a net difference from this factor alone of 6.6 g-CO2e/kWh.

In fact, China's investment in nuclear plants that take so long between planning and operation instead of wind or solar resulted in China's CO2 emissions increasing 1.3 percent from 2016 to 2017 rather than declining by an estimated average of 3 percent. The resulting difference in air pollution emissions may have caused 69,000 additional air pollution deaths in China in 2016 alone, with additional deaths in years prior and since.

7. Waste Risk

Last but not least, consumed fuel rods from nuclear plants are radioactive waste. Most fuel rods are stored at the same site as the reactor that consumed them. This has given rise to hundreds of radioactive waste sites in many countries that must be maintained and funded for at least 200,000 years, far beyond the lifetimes of any nuclear power plant. The more **nuclear waste** that accumulates, the greater the risk of **radioactive leaks**, which can damage water supply, crops, animals, and humans.

On their point about desalinization:

1] its not happening in the status quo to an extent where it would be beneficial

Wilcynzski '24

Although this whole process of nuclear desalination may sound too good to be true to some, there are some negatives that help put this whole process into perspective. Because this technique involves using the nuclear power plants as energy to desalinate the water, there are possibilities that some of the radioactive materials could be released into the water itself. [1] Even though most plants already have safety precautions put into place, nuclear energy is a dangerous ingredient that could find its way into this potable water by way of an accident or even through leakage.

Desalination is in the works but is terrible for the ocean

Trotta, 7/30. (Daniel Trotta is a reporter at Reuters) "Desalination advances in California despite opponents pushing for alternatives." Reuters. https://www.reuters.com/world/us/desalination-advances-california-despite-opponents-pushing-alternatives-2021-07-28/. 7-30-2021. accessed 8-30-2021 // Gayden

Environmentalists say **desalination decimates ocean life**, costs too much money and energy, and soon will be made obsolete by water recycling. But as Western states face an epic drought, regulators appear ready to approve a desalination plant in Huntington Beach, California. After spending 22 years and $100 million navigating a thicket of state regulations and environmentalists' challenges, Poseidon Water is down to one major regulatory hurdle - the California Coastal Commission. The company feels confident enough to talk of breaking ground by the end of next year on the $1.4 billion plant that would produce some 50 million gallons of drinking water daily. "The Pacific Ocean is the largest reservoir in the world," said Poseidon vice president Scott Maloni. "It's always full." California's Coastal Commission is expected to vote on Poseidon's permit application before year's end. Other agencies also still need to sign off. But a key authority, a regional water board, approved a permit for the project in April on condition that the company increase its commitment to rehabilitate the nearby 1,449-acre (586-hectare) Bolsa Chica wetlands reserve, an important bird habitat, and build an artificial reef. The Coastal Commission may require Poseidon, controlled by the infrastructure arm of Canada's Brookfield Asset Management (BAMa.TO), to provide additional mitigation at Bolsa Chica or elsewhere, said Tom Luster, a senior environmental scientist on the commission staff. The political appointees and locally elected officials from coastal districts on the commission could choose their own course. California's water wars date at least to the late 19th century. This latest chapter shows grassroots movements can at least delay plans, if not halt them. A plant Poseidon has operated since 2015 down the coast in Carlsbad was approved locally before the state adopted regulations for desalination plants. Poseidon's Carlsbad plant, sold to Aberdeen Standard Investments in 2019, produces 50 million gallons of drinking water daily, enough for 400,000 homes and meeting 10% of San Diego County's water demand. It is the largest desalination plant in the United States. The Huntington Beach project would produce a similar amount, enough for 16% of the homes in the Orange County Water District, where 2.5 million people live. Steve Sheldon, the Orange County Water District's board president, in 2018 voted in favor of a provisional deal to buy 56,000 acre-feet of water per year from Poseidon for at least 30 years. He said he weighed the environmental arguments, which he called "fair comments," but that based on the science presented to him found the impact on ocean life was "by and large de minimis." "We have to balance that with our human need for water," Sheldon said. While current drought conditions are particularly dramatic, California has seen extremely dry years for most of this century. Scientists say human-influenced climate change has exacerbated the situation. Largely because of the energy required, the desalinated water that Southern California plants sell to local water authorities is the most expensive alternative to water brought in from the Colorado River and Northern California. The Carlsbad plant has added $5 to the monthly bill of the average consumer in San Diego County, Poseidon says. The Huntington Beach plant would add $3 to $6 per month, the Orange County Water District said. Andrea Leon-Grossmann, director of climate action for the ocean conservation group Azul, says better alternatives include conservation, repairing leaky pipes, capturing storm water runoff and committing to more recycled water. At the Carlsbad plant, ocean water is run through pipes to remove the largest solids, then pumped to reverse osmosis filters to remove salt. The intake kills tiny organisms such as larvae and plankton. Some fish and other creatures die upon being sucked in or from the force of the water flow. Both Poseidon plants are now required to add finer intake screens to protect more fish. Poseidon's Maloni said that no more than

.02% of the plankton at risk of being sucked in would be affected at Huntington Beach and that no threatened or endangered species are at risk. Experts say **more research is needed** to determine how much sea life is destroyed by the Carlsbad plant, which, as Huntington Beach would do, uses intake pipes built for a retired power plant's cooling system. A 2015 state environmental report by staff of the State Water Resources Control Board examined studies on 18 power plants taking in water for cooling. The report found that on average from 2000 to 2005, **19.4 billion larvae were caught up at intakes and about 2.7 million fish**, along with marine mammals and sea turtles, were killed by intake equipment. "The reality is, we are impacting that environment for this generation and the generations to come," said Newsha Ajami, a hydrologist and director of Urban Water Policy with Stanford University's Water in the West research institute. For every gallon of drinking water, desalination leaves behind another gallon of salty brine. Carlsbad mixes that with two parts of ocean water before discharge. Huntington Beach would pump brine out to sea with a diffuser, which reduces the harmful impact of the dense discharge that falls to the ocean floor. The combined effects of intake and discharge in Huntington Beach will kill off the equivalent of all the marine life produced in 421 acres of ocean habitat, according to a Santa Ana Regional Water Control Board staff report. Maloni, the Poseidon vice president, said the impact on marine life would be "insignificant." "And to the extent that there are impacts, they'll be fully mitigated in compliance with local state and federal laws and regulations," Maloni said.

On their point about energy poverty

Renewables literally solve

Renewables solve.

Kristina **Karlsson &** Lauren **Melodia 23**, Deputy Director, Climate Policy, Former Deputy Director, Macroeconomic Analysis, “Energy Price Stability: The Peril Of Fossil Fuels And The Promise Of Renewables”, Roosevelt Institute, May 2022, https://rooseveltinstitute.org/wp-content/uploads/2022/05/RI_EnergyPriceStability_IssueBrief_202205.pdf - SDP

A Whole-Of-Government Energy Transition

Electrified, **renewable energy** can provide the **stability** our society needs and is a crucial step in the green transition necessary to slow the progress of climate disaster. The faster we transform our energy infrastructure, the quicker we will be able to experience the relief that price stability of renewable energy sources can provide. However, this transition cannot be left to individual consumers’ and business owners’ choices, especially for the transition to be rapid and equitable. Investing in this new system requires a government-led approach.

Policymakers cannot wait until fossil fuel-driven inflation comes back down. As we have shown in this issue brief, energy price volatility is a long-standing phenomenon that will continue so long as our economy relies on fossil fuels, and current fossil fuel-driven inflation should not discourage crucial **federal spending** on a renewable transition. Instead, the **inflation** we are experiencing is an urgent signal that public investment is necessary, and should be a strong motivating force to dramatically reduce our reliance on fossil fuels and secure long-term energy price stability.

Congress must provide sufficient fiscal spending for the capital-intensive build out of **wind** and **solar** utility infrastructure as well as public and personal electric vehicle infrastructure in order to achieve net-zero greenhouse gas emissions by 2050. Congress must also pass legislation that mandates and commits building owners to increase energy efficiency and electrify building infrastructure. Federal spending toward a renewable transition must ensure that 40 percent of overall benefits flow to disadvantaged communities in line with Biden's Justice40 initiative (Daly 2022). In launching a green transition, the federal government has the opportunity to not only reduce price pressures on low-income, Black, and Latinx households, but to proactively reinvest in communities that have historically faced the worst of climate change and of white supremacist policy. It is crucial that an electrified, renewable energy-based economy not reproduce the structures of inequality we are fighting to dismantle.

The Federal Reserve cannot rely on traditional monetary policy to reduce price volatility from fossil fuels, as raising interest rates will not relieve inflationary pressure from gasoline and natural gas prices. To manage an orderly transition away from fossil fuels, the Fed must adopt a precautionary approach to climate-related risk as part of its mandate to foster economic conditions that achieve stable prices and ensure the safety and soundness of the financial system (Arkush and Karlsson 2021).

Together, urgent adoption of these policies can transform energy's role in our economy—from precarity and volatility to stability