Introduction

Nuclear power has an image problem. Real world disasters aside, the thought of nuclear power conjures images of glowing green goo with human beings mutated beyond recognition. There are several pop culture icons that depict the harm of nuclear power – Godzilla and The Hulk, to name a couple. I can't think of any superheroes that positively depict Nuclear Power – I guess Captain Atom's a good guy, but he's infamous for being detonated constantly.

With all the bad press, it makes sense that the public is uncomfortable with nuclear power generation. Environmentalists such as Greenpeace and the UK's green party, stand against nuclear power, even though it would benefit them the most. Despite these strong opinions, the majority feel ill-informed regarding nuclear power – 86% of Americans felt that they were "not at all informed" and 76% of Europeans felt anywhere from "not very well informed" or worse. This is a problem because one's knowledge on nuclear power is tied to one's support for nuclear power.

This paper exists to clear up some of the misinformation around nuclear power. In my research, I've observed that the risks involved with nuclear power are overstated. Meanwhile, its utility for climate change activists is often downplayed in favor of other renewables. Researching nuclear power is daunting, since a lot of information is hidden behind complex scientific papers and strange vocabulary – hopefully, this paper is less intimidating.

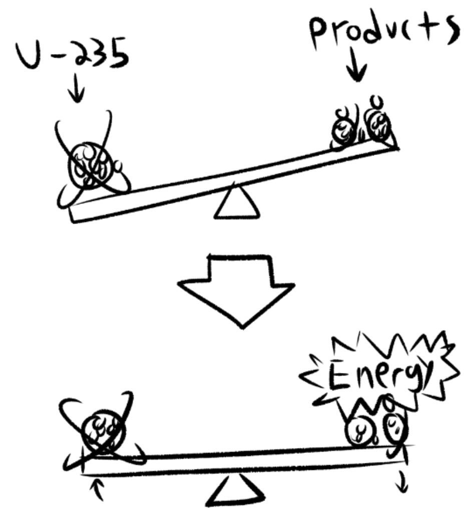
While I am not a nuclear scientist, I have done my fair share of research. I have read hundreds of pages worth of scientific papers, government regulations, news articles, and more. I have no stakes in the creation of new nuclear power plants, besides benefitting from Climate Change getting put under control.

In the first half of this paper, I'll discuss issues around nuclear safety - the three major disasters, nuclear terrorism, nuclear proliferation, nuclear waste, and radiation. In the second half, I'll highlight a few technological developments, compare nuclear power to other forms of renewable power, and make a case for nuclear power's necessity for combating climate change. Towards the end, I'll have a bonus section about why the misinformation around nuclear power and how the fossil fuel industry's influenced the perception of nuclear power.

Background Information

Before that, some general information – discussions around technological upgrades won't make much sense unless you have an idea of the way a nuclear power plant generates electricity.

The source of nuclear power's energy isn't obvious. Natural uranium is mostly uranium-238 and just a *little* bit uranium-235. U-235 can do fission – when it absorbs a neutron, it splits off into two smaller atoms and a few neutrons, which also releases a *ton* of energy. The energy seemingly comes from thin air – until you compare the mass of U-235 and the total mass of all the junk it splits into. U-235's mass is slightly greater than the sum of its parts and since matter cannot be created or destroyed, that extra mass must've gone *somewhere*. That's where $E=mc^2$ comes in. It states that energy is just a condensed form of matter - the missing mass was converted directly into vast amounts of energy. This is why nuclear power plants generate so much power with so little uranium.



There's a catch – U-235 might be fissile (i.e., able to undergo fission and split, releasing energy), but U-238 isn't fissile, and the percentage of U-235 in natural uranium is too low. If you "enrich" natural uranium (i.e., increase the percentage of U-235), then fission becomes more viable. Enriched to 90% U-235, you have a nuclear weapon. In a nuke, an atom of U-235 gets split, releasing energy and a few neutrons. Those neutrons will go on to hit another atom of U-235, splitting it, releasing even more energy. This continues until you've released enough energy to destroy a whole city. Of course, this does not happen in a nuclear power plant. First, the fuel isn't enriched enough. While bomb-grade uranium is enriched to 90% U-235, nuclear fuel is enriched to 3-5% U-235. Second, the core is cooled with water (or other materials – more on that later). Third, nuclear reactors come with neutron absorbers. Chain reactions in nuclear bombs get out of control because of all the neutrons flying around. Something like an array of boron control rods absorbs excess neutrons, preventing those out of control chain reactions. Manipulating individual control rods can also allow you to control the intensity of the reactions, meeting specific electrical demands.

All of the heat released from the nuclear reactor needs to be converted into electricity – thankfully, this is the easy part. Most reactors use heat to boil water. The boiling water is converted to steam, which spins a turbine. The turbine spins a generator, which is filled with magnets, thus inducing an electrical current in the cables.

Nuclear Disasters

When people think about nuclear power, the disasters readily come to mind – Chernobyl (Ukraine/Soviet Union, 1986), Three Mile Island (Pennsylvania, US, 1979), and Fukushima (Japan, 2011). There's a general fear that nuclear power plants are so unstable that they could spontaneously explode and kill everyone in the area, poisoning the world for decades. Of the three, the Chernobyl accident was the deadliest and most prominent event, so I'll discuss it first.

Chernobyl

The Chernobyl accident was caused by three weak points – a fatal flaw in the reactor design, negligent management, and an incompetent government. The Chernobyl reactor's design had an issue – at *low power*, the control rods (built to slow the reactions) caused a brief spike in reactivity. The sudden surge in power boiled the water, which produced a lot of steam very quickly, which increased the air pressure. The high pressure also jammed the control rods – they were only inserted halfway into the reactor, leading to further increased reactivity. The high air pressure caused an explosion, releasing radioactive material. There was also a second explosion, likely caused by a hydrogen buildup. The Chernobyl reactor exploded because the reactor ran at low power for an extended period. Then the management tried to downplay the severity of the incident, which unnecessarily drew out the cleanup operations. Since it was the Cold War, the Government of the Soviet Union tried to cover up the incident, which is the main reason why the civilians nearby received such a high dose of radiation.

Given how badly the engineers, the management, and the government fumbled Chernobyl, I assumed that hundreds, if not thousands, died immediately after the meltdown. Which is why it's such a surprise that there are only 30 deaths directly attributed to the Chernobyl meltdown. 2 workers died in the initial explosion and 28 firefighters/workers died due to acute radiation syndrome. 30 deaths *is* terrible, but it's also 1/3rd the quantity of fatal injuries in the fossil fuel mining industry in 2021 and less than the number killed in school shootings in 2022.

Estimating the number of long-term deaths from Chernobyl is trickier. In truth, nobody knows how many people contracted cancer and died thanks to the increased background radiation and fallout. There's an entire Wikipedia page dedicated to the dispute around these numbers. The IAEA attempted to research the effect of Chernobyl on people's health. They compared the people affected by radiation with a control group, but there wasn't a significant health difference between the two. The only clear effect was an increase in Thyroid cancer, which is considered one of the most treatable cancers, with a 98% survival rate. The UNSCEAR's 2000s report says "apart from this [thyroid cancer] increase, there is no evidence of a major public health impact attributable to radiation exposure 14 years after the incident. There is no scientific evidence of increases in overall cancer incidence or mortality or in non-malignant disorders that could be related to radiation exposure. ". Keep in mind – the Chernobyl accident is considered the deadliest nuclear accident.

The post-Chernobyl improvements are interesting. It's worth noting that most reactors cannot meltdown like Chernobyl did – the design flaw is specific to Russia's RBMK reactors. It didn't have a containment structure – even Three Mile Island had one, which mitigated damage from that event. However, most of Chernobyl's destruction was caused by incompetent management, rather than failed technology. The operators put the reactors in a "dangerously unstable condition" that "virtually guaranteed an accident", but they weren't violating any operating policies, since there weren't any at the time. The Technical improvements were good - the Soviet Union spent $400 million on fixing the reactors at Chernobyl, they added a containment structure weighing 36,000 metric tons, and automatic shutdown mechanisms were improved worldwide, but the most important post-Chernobyl changes were stricter policies and laws.

Three Mile Island and Fukushima

Between the Three Mile Island meltdown and the Fukushima meltdown, how many people do *you* think died?

If you guessed 0 deaths, you'd be correct! This number surprised me – I assumed that hundreds of people died during these two accidents, given how salient these events are. Even in the worst cases, nuclear power is *much* safer than people realize. With Three Mile Island, people didn't even realize the reactor melted down thanks to all of the protection and shielding built around the reactor.

Three Mile Island was straightforward. Something prevented water from being pumped away from the core, which automatically shut down the reactor. While the core cooled down, the water boiled, which increased the internal air pressure. Operators opened a valve to decrease the pressure. The pressure decreased to a safe amount, but the valve was left open – the steam/water intended to cool the reactor was leaking. The operators, however, were unaware that the core was insufficiently cooled. Existing equipment couldn't determine if water was cooling the core, which led to a meltdown. While there were technological improvements, such as better fire protection, backup water pumps, and upgraded meters/valves, the biggest improvements had to do with safety culture, emergency preparedness, and better operator training.

Fukushima's a little more interesting. First, a magnitude 9.0 Earthquake caused the reactors to automatically shut down to avoid causing further issues. Reactors don't cool down instantly, so backup generators are needed to pump water into the reactors. Unfortunately, the earthquake triggered a Tsunami, which knocked out some of the backup power generators. The water inside started boiling – the heat and radioactivity also caused a hydrogen buildup. The steam and hydrogen increased the air pressure, making it harder for water to get pumped into the core. Eventually, the hydrogen buildup caused an explosion, releasing radioactive materials. This likely wasn't helped by the water in the spent fuel pool boiling away.

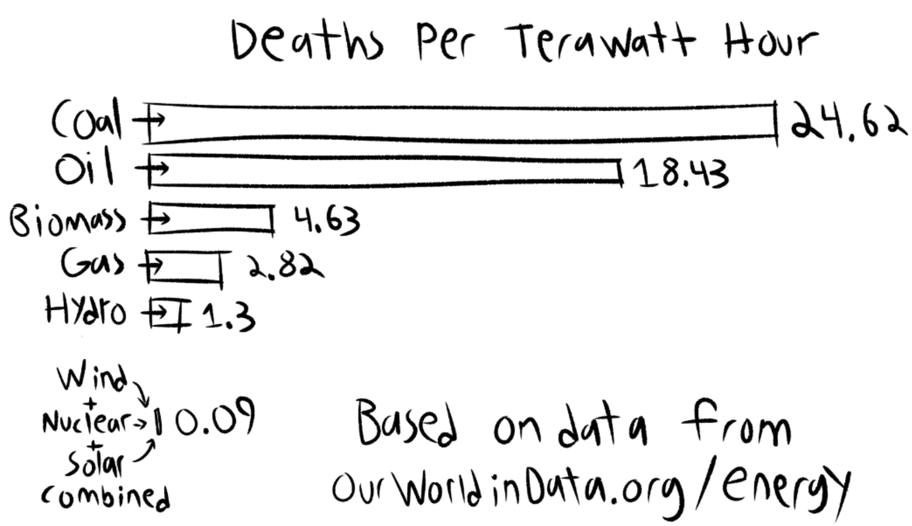
A few things – first, the explosion was a combustion explosion of hydrogen gas – not a nuclear fission explosion. In fact, it's physically impossible for a reactor to explode like a nuclear bomb. The uranium isn't enriched enough for that to happen.

Second, this accident only happened because of a powerful Earthquake and a Tsunami – events that're inherently destructive and something that Japan experiences more often than other countries.

Third, the response to this event was overwhelming - backup generators were moved to safer locations and some portable ones were stored off-site in bunkers so that they'd be protected from natural disasters. Spent fuel pools in the west already had an additional layer of shielding below the water, better monitors were still added for checking the water level. Multiple heavy-duty vents were added to prevent pressure buildup. Regulators that automatically recombine hydrogen with water were also added. The placement of nuclear reactors was reassessed, and some were elevated to protect the power plant from flooding, along with a few other standard natural-disaster protections. Offsite, rapid response centers can guarantee backup equipment and assistance within 24 hours. The intent is clear: A Fukushima accident can never happen again.

Death Rates, More Generally

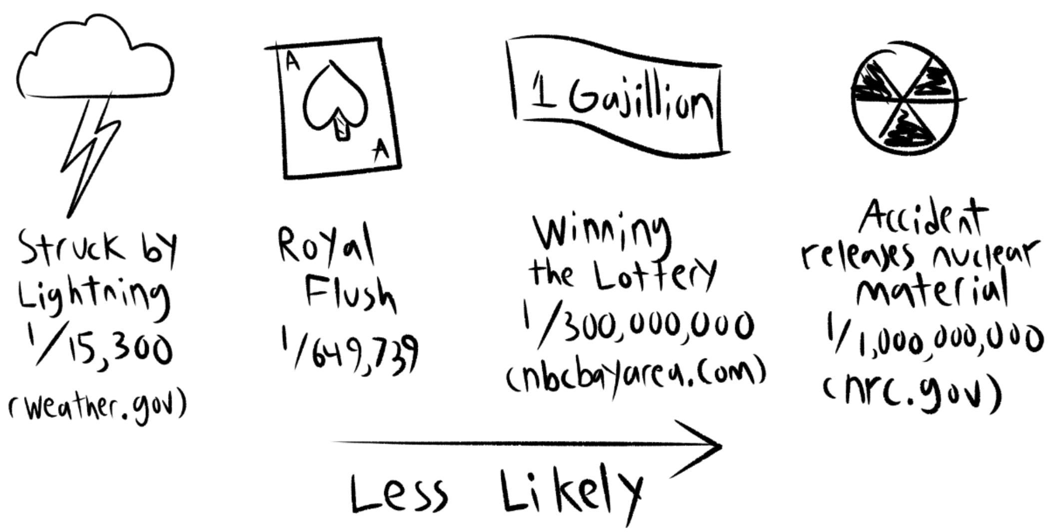
With the low death counts on the three *worst* nuclear power plant disasters in history, it isn't surprising that the death rates for nuclear power are *incredibly* low. Based on data from the World Health Organization and the CDC, including deaths from Chernobyl, nuclear has a mortality rate of 0.04 deaths per terawatt-hour. For reference, coal incurs 100 deaths per terawatt-hour, oil kills 36, and hydro has 1.4. Other data is even more damning – here, nuclear has a death rate of 0.03 deaths per terawatt-hour and has the lowest death rate, second only to solar. Hydro, compared to the other renewables, still has a surprisingly high death rate, which I assume is because of the deaths that happen when dams break/flood or the floods poisoning indigenous people with mercury. Sometimes, people forget that other renewables aren't perfect, though they're still better than traditional fossil fuels.



Nuclear Risks

Spent Fuel Transportation

Short aside - carrying and transporting nuclear materials seems tough. However, according to the NRC, they've been transporting spent fuel safely for more than 40 years. These containers have shielding 5-15 inches thick and are designed to survive railway and highway accidents. They're also tested to survive impacts, punctures, fire, and submersion in the water. These containers have so much protection that trucks carrying them can weigh 25 tons. Rail containers can get even heavier, weighing 150 tons apiece. More importantly, this protection *works* - over 1300 fuel shipments, 4 were in accidents and the radioactive material was still contained. The NRC calculated the chance an accident releases nuclear material into the world – it's less than 1 in 1 billion. Astonishingly low odds, but it makes sense given all the precautions.



Nuclear Terrorism

Similarly, nuclear terrorism seems like a big issue. There's a post-9/11 fear that someone would crash an airplane into a nuclear power plant, but these fears are overblown. Analysis from the EPRI revealed that a max-speed fully fueled Boeing 767 wouldn't come *close* to breaching the containment around a nuclear power plant. After all, there's a *lot* of shielding and containment in case a meltdown happens. Similar analyses revealed that no radioactive waste would leave the site after an attempted attack, thanks to all the shielding. While you can *technically* attack a nuclear power plant, it is *less* practical than most other landmarks, given the incredible amount of reinforcement.

Despite the unlikelihood and ineffectuality of a nuclear terrorism attack, the NRC still enforces other precautions. They have intrusion detection, intrusion-response training, alarm assessment, armed escorts, and the ability to summon offsite assistance, in case of an emergency, making potential nuclear terrorist attacks even *less* deadly.

There's another fear that terrorists will intercept nuclear materials for use against the public. However, this isn't likely either - according to an article from the InterAgency journal, the fear of this style of nuclear terrorism went up post-9/11, but it hasn't happened for the several decades that the US has utilized nuclear power. Additionally, it'd be difficult for terrorists to steal nuclear materials. As discussed previously, those shipping containers are *incredibly* heavy and difficult to sabotage. Even if a terrorist group could crack the containers, they'd need to handle highly radioactive substances – something difficult to accomplish if you don't have government funding. Plus, the radioactivity makes it so that any stolen fuel is easy to track. nuclear terrorists probably have a better chance mining and enriching the Uranium manually, and at that point it isn't the responsibility of anyone involved with nuclear power.

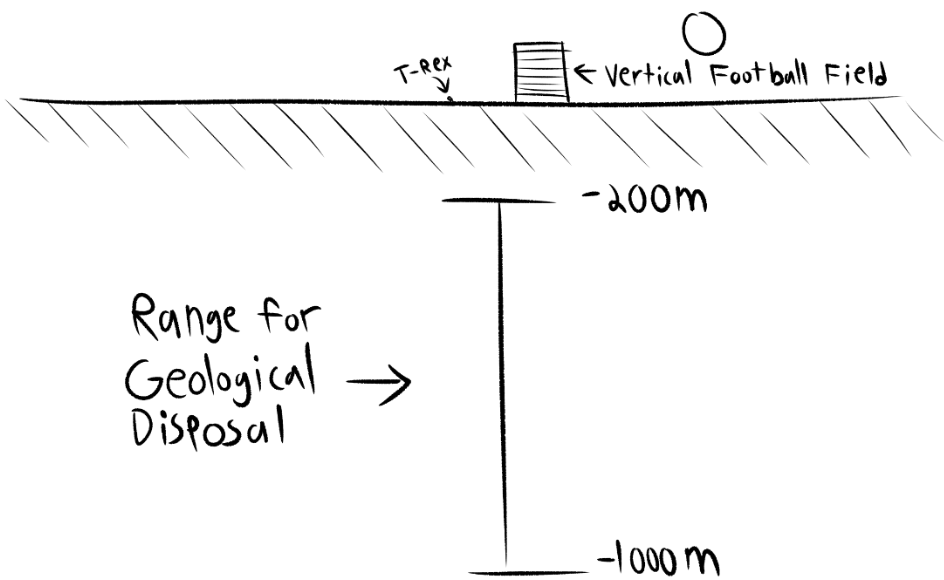
Nuclear Proliferation

Along with nuclear terrorists, people are afraid that the government will use nuclear power plants to create weapons. With respect to nuclear power plants, nuclear proliferation is the fear that governments will divert uranium from uranium enrichment plants into nuclear bombs. There are a few barriers - for one, technologies such as the Thorium Fuel Cycle are proven to have "excellent non-proliferation credentials", meaning that the material is harder to make bombs from. For another, there are legal barriers, the main one being the Nuclear Non-Proliferation Treaty, signed by 191 countries. The NPT bans the distribution of fissile material for the purpose of creating nuclear bombs - countries found violating it are subject to an enormous list of sanctions, isolation, and inspections/scrutiny from the UN Security Council. The NPT also puts the IAEA in charge of running nuclear power plant inspections and preventing nuclear resources from being diverted into weapons.

If you are a country afraid of making nuclear bombs, there is a simpler option – just don't build them. Nobody's forcing you to make a nuclear bomb if you have nuclear power plants in your country. There's even legal precedent for doing the opposite – breaking down nuclear bombs to utilize their uranium in nuclear power plants. It's called the Megatons to Megawatts program, and it managed to reprocess 20,000 atomic bombs worth of material into fuel. If you're worried about nuclear material being converted into weapons, it might be worth it to advocate for similar reprocessing programs.

Nuclear Waste

Nuclear waste seems difficult to handle. One of the most commons methods is Geological Disposal – you put it 200-1000 meters underground in an "engineered geological disposal facility" designed to prevent radiation from being released into the environment. There are several layers to this system– a layer of glass, a metal container, then bentonite clay or cement. The clay's useful because it swells when it meets water, making it airtight. It isn't easy to retrieve material disposed this way, but Geological Disposal is for more dangerous high-level radioactive waste (which makes up 10% of total nuclear waste by volume). You wouldn't really want it back. If you still think that it's too close to the surface, boreholes can create a Deep Geological Disposal site 2000-5000 meters underground, but it isn't necessary.



Radiation also appears difficult to handle. There isn't a definition for a "safe dose" (more on that later), but the NRC still wants to limit everyone's exposure to radiation. The NRC's regulations put a limit of 100 mrem/year on the amount of radiation an ordinary citizen should receive from anything nuclear power related. In practice, people who live near nuclear power plants receive less than 1 mrem/year – to put that into perspective, we receive around 620 mrem per year from other sources such as space, the earth, or medical equipment. For reference, an

NCRP report also states that doses below 10,000 mrem/year won't measurably increase the risk of birth defects and miscarriages. Radiation from nuclear power plants is *much* less dangerous than people are led to believe.

Recent Technological Developments

If you're still concerned about the disposal of nuclear waste, technologies such as fuel Reprocessing might help. Depleted uranium is a byproduct of uranium enrichment and the U-235 content is too low within depleted uranium for it to generate enough heat for a nuclear power plant. Reprocessing this nuclear waste allows you to extract the remaining fissile material, giving you more fuel for reactors and reducing the high-level radioactive waste to 20% of its original volume. You can also transmute those long-lived waste products with fast neutrons – it's how "Fast Reactors" are able to generate power using nuclear waste. The fast neutrons transmute materials such as neptunium, curium, and americium into fissile products, leading to even greater efficiency. This isn't untested technology either – Russia, China, and Japan already have policies for reprocessing nuclear waste. 16,000 tonnes of reprocessed uranium from reactors in the UK were converted into reactor-ready fuel. While the US doesn't have any reprocessing plants, there are already plans for putting a few into operation.

For a Pressurized Heavy Water Reactor, uranium enrichment is an unnecessary step, since it can process natural uranium. The waste products from Pressurized Heavy Water Reactors aren't practical for reprocessing, but that's more because they work so efficiently from the beginning. Light Water reactors use normal water for cooling and electricity generation. However, the downside of light water is that it can sometimes absorb neutrons, which means that lower concentrations of U-235 won't generate enough power before all the neutrons get absorbed. Heavy water uses an isotope of hydrogen, known as deuterium, which doesn't easily absorb neutrons. Therefore, heavy water can act as a cooling agent and a neutron slower, allowing it to sustain reactions in naturally occurring uranium without stealing all the neutrons.

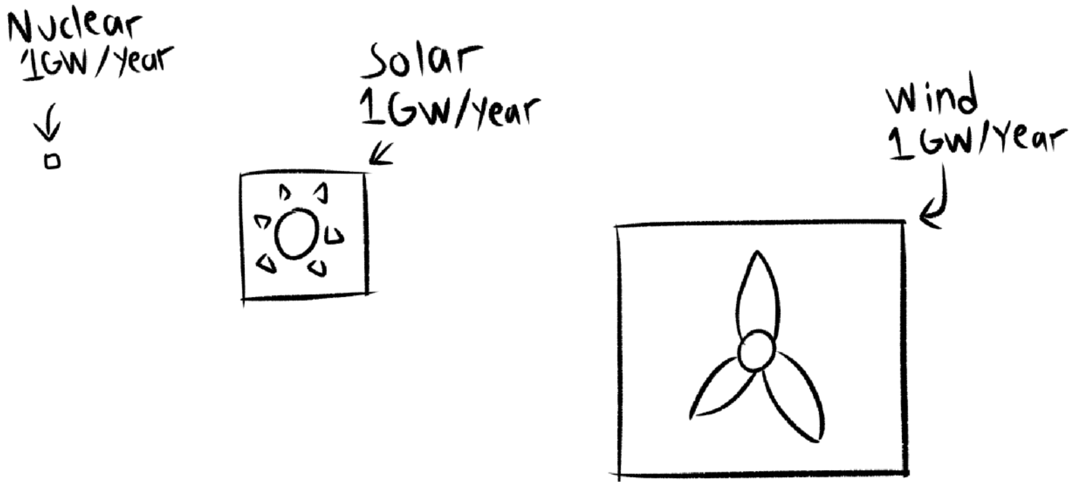
Some may consider nuclear power nonrenewable since uranium is technically finite – however, uranium extraction from seawater may change that. While there's 7.6 million metric tons of uranium on land, there's 4.5 *billion* metric tons of uranium in the ocean. Seawater uranium is also replenished continuously – it's functionally endless, similar to geothermal power. While uranium extraction from seawater is more expensive than mining it, due to the slower rate of extraction and the complex chemical processes, there's an argument that seawater extraction is necessary for "reducing energy insecurity" in poorer countries that don't have access to land uranium and don't have the infrastructure for mining it.

If seawater uranium isn't common enough for you, thorium is literally found in the dirt. Thorium is three times as abundant as uranium in the earth's crust, making it especially attractive for nuclear power plants. While thorium itself isn't fissile, it *is* fertile – when thorium absorbs a neutron, it gets converted to U-233, which *is* fissile, producing around the same amount of power as U-235. This sounds new, but the technology's been tested extensively. The Peach Bottom reactor in the US managed to generate 33 *tera*watt hours worth of electricity over 1349 days. They've also been in use around the world - Canada's Chalk River Labs, the UK's Dragon, and Germany's Atom Versuchs Reaktor are all examples of thorium's power. There are also a couple of small bonuses – it generates less long-lived radioactive waste than plutonium and uranium, and it works very well with Molten-Salt reactors, which use molten salt instead of water, allowing them to run more efficiently than their light-water based counterparts and consume less water, which is another common concern.

Comparisons to Renewable Power

Despite nuclear power's proven safety, the public prefers other renewable resources, such as wind and solar. While nuclear power plants will expose you to less than 1 mrem/year, as mentioned earlier, wind and solar farms don't produce *any* ionizing radiation, which makes them "feel" safer - it's probably why they poll better than nuclear power. As such, environmentalists worldwide are drafting 100% renewable energy plans without nuclear power, including the UK's Green Party. As I will discuss in this section, however, these plans are short-sighted, needlessly expensive, and may lead to even *more* environmental damage and lives lost.

Nuclear power is more land efficient and consistent than wind and solar. An average nuclear power plant 1.3 square miles big can produce 1,000 megawatts in a year, running at 90% capacity the whole time. A wind farm would need 260-360 square miles of land and requires a potential capacity of 1,900-2,800 megawatts per year to produce the same amount of power. The capacity is much higher than 1,000 megawatts per year because of wind power's inconsistency, which reduces its capacity to 23-47%. Solar power requires 45-75 square miles to do the same thing, demanding an even *greater* capacity – 3,300–5,400 megawatts. Again, this increased power requirement is a necessity since solar runs at 17-28% capacity. For comparison: you'd need 3 million solar panels or 430 wind turbines to match an average nuclear power plant.



Zero Carbon Goals

Land efficiency and consistency are important, since they're the main bottlenecks for 100% renewable energy plans. In response to several studies that didn't properly account for uneven resource distribution (like in the real world), this study from the Journal of Applied Energy ran PLEXOS electricity simulations that take into account uneven resource distribution, geography, weather, and cross-border energy infrastructure. While these simulations revealed that 100% renewable energy plans *can* work without nuclear power, there are a few issues.

First is that it'd cost a lot – they estimate it'd cost 560 billion euros per year (a little over $580 billion). For reference, the EU spends between 300 and 400 billion euros per year (around $311 billion to $415 billion). Implementing disallowed technologies, such as nuclear, drops the cost per year to around 410 billion euros ($425 billion), which is more manageable.

Second – non-nuclear plans depend greatly on biomass, which comes with its own problems. The problem is that both solar and wind have a lot of potential, but are inconsistent, relying heavily on the weather. When wind and solar can't meet the grid's energy demands, biomass needs to fill the gaps, since it can scale up electricity production on-demand, similar to nuclear power. Unlike nuclear power, however, biomass is abysmally land inefficient. Solar, which is itself inefficient, is 100 times better than biomass at converting solar power into energy.

Biomass' zero-carbon status is dubious, since some biomass utilizes plants that were *already* gonna grow, making the absorbed CO2 sunk cost (or a sunk benefit?). To make matters worse, farmland for biomass could instead be used for food and feeding the hungry. Increasing the deployment/capacity of biomass by several gigawatts per year would make it even harder to meet the food demands of a growing world.

Third – cross-border electrical capacity would need to *greatly* increase. It'd need to go up to anywhere from 142 GW and 416 GW compared to today's 60 GW. Power plants wouldn't end up evenly distributed across the continent – some areas would produce more power than others. The inconsistency of solar and wind power further exacerbates the imbalance. Energy storage wasn't considered, because that comes with its own issues. Compressed air storage is inefficient, returning only 50% of the energy originally generated. Lithium-Ion is great for mobile devices, but it doesn't scale – Lithium isn't common enough to meet the demands of grid storage and the batteries don't last long (as any iPhone owner can tell you). Pumped Hydro facilities *might* work as they make up 90% of post-generation grid storage, pumping water upwards and releasing water to generate energy on demand. These are, however, land inefficient – they need to be built near a large body of water and several hills, meaning that they don't scale well. Additionally, Pumped Hydro facilities also pose the same risks as Hydropower, which is the deadliest form of renewable power.

Nuclear power fixes all of these issues– it's land efficient (and can be shrunk further thanks to Small Modular Reactors), can be built anywhere (large sources of water aren't required for Molten Salt reactors), and can run on-demand 24/7 at nearly 100% efficiency. Additionally, Nuclear power is tried and tested – it can fulfill all your zero-carbon renewable energy demands without much improvement. To show how efficient they are, Nuclear power plants in a land mass less than the size of Vermont, could supply the whole world's electricity.

At the very least, you shouldn't shut down existing nuclear power plants. Recently, Germany shut down all of its nuclear power plants, which a study in Scientific Reports called "incredibly short-sighted". The shutdown is estimated to cause 25 million tons of carbon emissions – for reference, this is equivalent to the yearly emissions of nearly 6 million gas-powered cars. In the US, California's closing of the San Onofre plant caused a 35% increase in carbon emissions for the state, while Vermont increased their carbon emissions by 650,000 tons after closing their own power plants. There's evidence that the increased air pollution disproportionately impacts Black families as well as lower-income populations. The association is explained both by the location of these disadvantaged communities (i.e., nearby pollution sources) and decreased access to healthcare. which makes these safety-driven shutdowns even worse. Nuclear power's prevented anywhere between 1.84 million deaths and 7 million deaths, thanks to all the CO2 that it displaces. If you won't let the reactors run to save lives, at least do it to save a few bucks – the NRC estimates that it costs anywhere between 290-370 million to decommission a nuclear power plant and the IAEA says it costs between 500 million and 2 billion per power plant. Additionally, the process takes a decade and a half. Given that the fuel is the cheapest part of a nuclear power plant, closing existing power plants is the *least* efficient thing you can do.

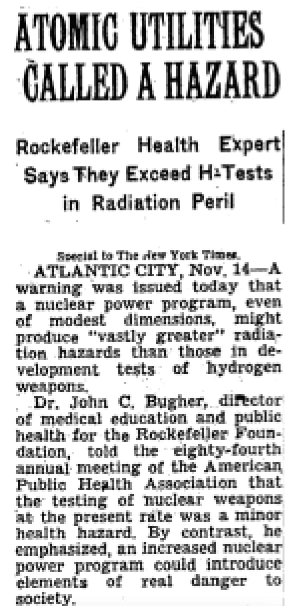
Nuclear Misinformation

There's a disconnect between the public's "knowledge" regarding nuclear power and the reality of nuclear power. According to the Eurobarometer poll, only 20% of European citizens support nuclear power in their country. 36% are neutral and 37% are opposed to it. Only 46% agree that nuclear power limits global warming. 65% of people in *France* don't believe that a nuclear power plant can be operated safely, which is bizarre since 80% of their electricity comes from nuclear power. Additionally, the public's biggest concerns are nuclear terrorism, nuclear proliferation, and nuclear waste, which are all solved problems, as discussed previously.

Unsurprisingly, most of the "debate" around nuclear power comes from a lack of knowledge. There's a positive correlation between knowledge of nuclear power (along with education level) and support of nuclear power. Half of this disconnect is the nuclear industry's fault, but the other half is absolutely the fossil fuel industry's fault.

In my research, I had a hard time finding intermediate sources. It was easy to find information made for beginners and ultra-detailed scientific articles for nuclear scientists, but it was harder to find resources for citizens who'd be comforted with a *little* more knowledge. For example, if someone happened to hear about uranium extraction from seawater on the radio, they would want to know more, especially if they're concerned that nuclear power isn't *fully* renewable. However, their only two options are a news article that boils down to "there's uranium in seawater! We can use that!" or a scientific paper that's 100 pages long and opens with a detailed description of the exact chemical processes for extracting uranium. My guess is that the obfuscation of anything nuclear started with the Manhattan project and the Cold War, and scientists just kept everything incomprehensible out of habit.

The Fossil Fuel Industry's created a *lot* of anti-nuclear propaganda. In the US, Fossil Fuel lobbying is tied to nuclear disasters - the Fossil fuel industry's donations increased by 40.5% right after Chernobyl, then increased by 145.5% right after Fukushima. In newspapers that were already tied to the fossil fuel industry, there was a 100% increase in fossil fuel ads after Chernobyl and a 20% increase in anti-nuclear articles. Exxon paid various political parties 27 million dollars over a ten year period to halt nuclear power development and fix prices. Anti-Nuclear groups, such as the Sierra club, Natural Resource Defense Council, Environmental Defense Fund, Greenpeace, and Friends of the Earth have received a lot of money from the fossil fuel industry, receiving 136 million, 70 million, 60 million, 400 million, and at least 200 thousand, respectively. To make matters worse, the donations worked – congressmen who received more money from fossil fuel companies were more likely to vote against nuclear power, especially right after Chernobyl. Given that the Fossil Fuel Industry *invented* the concept of the Carbon Footprint, none of those should come as a surprise.


ATOMIC UTILITIES CALLED A HAZARD

Rockefeller Health Expert Says They Exceed H-Tests in Radiation Peril

Special to The New York Times.

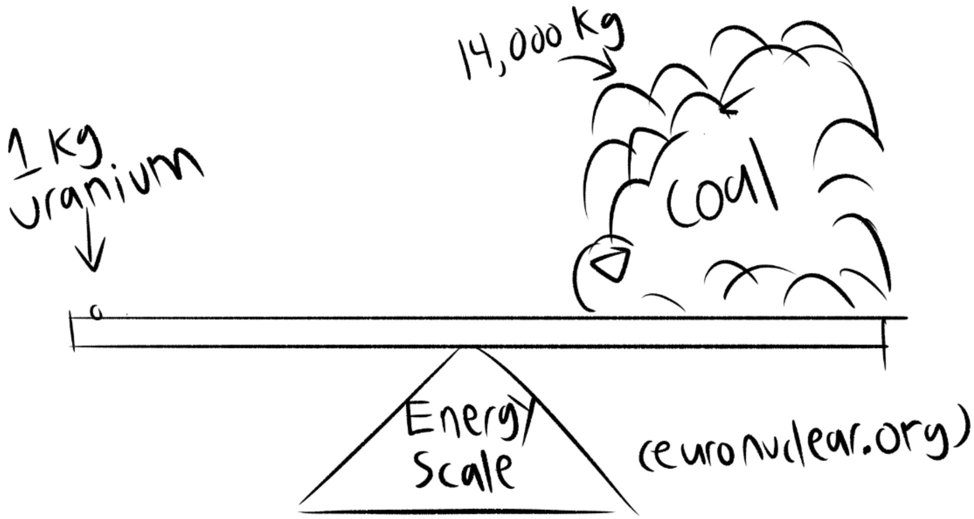
ATLANTIC CITY, Nov. 14—A warning was issued today that a nuclear power program, even of modest dimensions, might produce "vastly greater" radiation hazards than those in development tests of hydrogen weapons.

Dr. John C. Bugher, director of medical education and public health for the Rockefeller Foundation, told the eighty-fourth annual meeting of the American Public Health Association that the testing of nuclear weapons at the present rate was a minor health hazard. By contrast, he emphasized, an increased nuclear power program could introduce elements of real danger to society.

Making matters even worse, the fossil fuel industry funded and amplified the fear around the effects of nuclear radiation. The Rockefeller Foundation funded research from the National Academy of Sciences to prove that radiation was harmful to anything Biological. The results released state that there are "no safe doses of radiation" and how the harm would carry on invisibly for years to come, which is essentially impossible to disprove in a follow-up study. These findings would get a lot of traction, since the publisher of the New York Times was on Rockefeller's board of Trustees. In other words, the previously discussed confusion around the radiation that nuclear power plants produce was likely *manufactured* by the Rockefeller Foundation.

Conclusion

Nuclear power is absurdly safe, enormously power efficient, incredibly land efficient, and necessary for any decent zero-carbon plans to stop Climate Change. If you want to get rid of Nuclear Bombs, advocate for more programs like the Megatons to Megawatts program. If you want to cut down on nuclear waste, advocate for Fast reactors and Reprocessing. Don't just decommission every nuclear power plant in your state. At the very least, let nuclear power carry us safely away from the Climate Crisis before you swap in a more aesthetically pleasing source of power. Just please – don't let the misinformation around nuclear power doom the entire planet.



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