Distrust of Nuclear Power in the U.S.: An Inherited Constraint on Climate Policy

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The nuclear power industry in the United States has been around since 1951 and was once promised to be "too cheap to meter" (Strauss, 1954). Today, this is not the case and many Americans do not trust nuclear power as a viable means of producing energy. How has public distrust of nuclear power developed in the U.S. and how does it affect nuclear and climate policy? To prevent reaching the climate change temperature rise limit of 1.5 degrees Celsius, the globe must achieve net zero CO2 emissions by 2050 (IPCC, 2018). Nuclear power is poised as a tested, low-emission alternative to renewable sources. Renewables are the preferred option, however they have "not been able to catch up with the demand for new electricity" globally, and because of this, "emissions from electricity are still rising worldwide" (Kurzgesagt, 2021-b). Nuclear power offers a promising source of low-emissions energy, but before it can meet a greater share of energy demand in the U.S., the distrust must be better understood and mitigated. It is essential to understand how the public opinion on nuclear power is established and swayed, and what kind of influence it has on policy, to effectively increase the nuclear shares in the United States energy portfolio.

Review of Research

In 1954, Lewis Strauss, Chairman of the United States Atomic Energy Commission, contended that "our children will enjoy in their homes electrical energy too cheap to meter." Strauss' confidence highlights the US's perception of nuclear power in the 1950's. Breaking this unrealistic promise negatively affected the public trust of nuclear power.

Through interviews conducted 6 weeks after the Three Mile Island accident in 1979, *Chicago Tribune* reporters found evidence of public anxiety.

In a study of risk analysis in the energy sector, Weart (1988) uncovered deficient evaluations. For example, “government officials felt no urge to insist that their nations’ use of coal was poisoning forests for thousands of miles downwind” or “utilities did not rush to advertise that their hydroelectric dams could slay thousands as readily as any reactor” (1988).

In a study of media coverage and its influence, Palfreman (2006) contends that “public policy about ... crucial and complex issues” such as nuclear power and climate change “depends on public attitudes, which, in turn, tend to be strongly affected by mass media coverage.” He concludes that policymakers require expertise in risk assessment and communication.

Nuclear Power Distrust in the 1950’s Onward

The public distrust of nuclear power in the United States was established by a set of false promises from the government and developed by fear-based depictions in news and entertainment media over the past 50 years. Nuclear power has been around since the 1950’s and “initially the public was not overly concerned about living in a nuclear age” (Palfreman, 2006). President Eisenhower conveyed America’s acceptance of nuclear power to the United Nations during this time: “The United States knows that peaceful power from atomic energy is no dream of the future. The capability, already proved, is here today” (Eisenhower, 1953). The authorities on nuclear power made grand promises about nuclear power’s potential for the future, including its potential for every-day public use. Lewis L. Strauss, for example, guaranteed cheap energy due to widespread use of nuclear power: “It is not too much to expect that our children will enjoy in their homes electrical energy too cheap to meter…. This is the forecast for an age of peace” (1954). However, this promise never came to fruition. Nuclear power costs throughout the 20th century increased as more regulations were put in place, and between 1967 and 1980 the

cost of a nuclear power plant quadrupled (Cohen, 1990). These cost increases prevented nuclear from becoming 'too cheap to meter' and therefore did not meet one of the promises made by the authorities on nuclear power. This unkept promise drove the public away from nuclear as it did not turn out as promising as originally thought.

Alongside this unkept promise made by the government, the news and entertainment media also helped shift the public opinion of nuclear power. The 1950's popular culture references to nuclear technologies began to make nuclear more relevant in people's lives. In the 1960's there was "little negative press comment about nuclear reactors" (Palfreman, 2006). However, into the 1970's the media narrative changed: "this transformation was driven by popular culture, by antinuclear advocacy and by two highly publicized nuclear accidents" (Palfreman, 2006). The public's hesitancy and fear about the use of nuclear energy that grew during the 20th century is still present today.

In the 1950s, entertainment media groups saw an opportunity with nuclear technology themed productions: "From the beginning there had been two potentially disturbing elements of nuclear mythology: nuclear energy's mutagenic potential and its raw power. Writers and movie producers found both fascinating" (Palfreman, 2006). Movies such as Godzilla (1956), Them! (1954), The Day The Earth Stood Still (1951), The Beast From 20,000 Fathoms (1953), and Tarantula (1955) all utilize radioactivity as a plot device to create a sci-fi thriller. These movies were an attempt to ease the American paranoia of nuclear war and apocalypse at the time, since "a good horror/fantasy/sci-fi flick provides a healthy dose of escapism, but also keeps one eye fastened on what we wish to escape from" (Waldman, 2013). The belief was by including nuclear science concepts in popular movies, the public would get used to seeing or thinking about those ideas to hopefully ease the paranoia about nuclear war at the time. The 50's Sci-Fi

era maintains the focus on radiation and nuclear disaster and in doing so, frequently reminds the public of what they are afraid of, instead of helping ease their fear: “While the explosion of fantastic imagery across a movie screen can provide a momentary burst of pleasure (as well as terror), it leaves uneasiness in its wake. You are not numbed but sensitized. Questions and insecurities linger” (Waldman, 2013). This public sensitivity towards radioactivity fueled the constant fears of nuclear war (as was the Cold War culture in the US) and sowed the seeds for the growing anti-nuclear power movements.

The public distrust of nuclear power slowly grew through the 1960s and 70s. The distrust became much stronger after the Three Mile Island Accident; a partial melt down of the Unit 2 reactor on March 28, 1979 and the first accident that Palfreman references (2006). Three Mile Island “was the most serious accident in U.S. commercial nuclear power plant operating history”, yet the radioactive releases resulted in “an average radiation dose of only about 1 millirem above the usual background dose” (NRC Staff, 2018). The radiation effects of the Three Mile Island incident were relatively harmless, especially since “Americans receive a radiation dose of about 0.62 rem (620 millirem) each year” (NRC Staff, 2020). However, the potential for greater disaster was felt strongly by the nation, and the media raced to confirm their fears. Florence Smith, interviewed by the Chicago Tribune, spoke about the public’s opinion; “For the first time, people think it [an accident] could happen. Before, there was virtually no fear and certainly no organized opposition. But the accident changed the minds of a lot of people” (as cited in Yuenger, Brown, & Bukro, 1979). Catherine Quigg, the research director of Pollution and Environmental Problems, Inc at the time argued “every nuclear reactor should be shut down. Our health and our lives are too high a price to pay for electricity” (as cited in Yuenger et al., 1979). These feelings were shared across the nation: Three Mile Island’s “aftermath brought about

sweeping changes….it also caused the NRC (Nuclear Regulatory Commission) to tighten and heighten its regulatory oversight. All of these changes significantly enhanced U.S. reactor safety" (NRC Staff, 2018).

The public's reaction to the Three Mile Island incident was driven by the information they were presented by the media. Boyce Rensberger, the director of MIT's Knight Center for Science Journalism, said "balanced coverage of science does not mean giving equal weight to both sides of an argument. It means apportioning weight according to the balance of evidence" (as cited in Palfreman, 2006). It is common that "a mainstream, well-established consensus may be 'balanced' against the opposing views of a few extremists, and to the uninformed, each position seems equally credible" when in fact, they absolutely are not (Schneider as cited in Palfreman, 2006). This misleading trend in conjunction with journalistic pressures to not overly alarm or overly reassure the public led to reporting that ultimately affected the national opinion of nuclear power in a way that is still being undone (Stephens & Edison, 1982).

The second accident that influenced public opinion was the nuclear reactor meltdown at Chernobyl, "the worst nuclear disaster in history" (Blakemore, 2019). However, the incident was under reported at the time. Therefore, Chernobyl had a lesser impact on US public opinion of nuclear power and on US nuclear power regulations, relative to Three Mile Island. Instead, the incident served as a source of confirmation bias of the fear created by the Three Mile Island incident, representing for many people the outcome of all nuclear reactors. In this way, the Chernobyl disaster furthered public distrust of nuclear power in the US.

Public distrust of nuclear power was developed over the course of a few decades by unkept promises, the news and entertainment media, and a general lack of information. The

lack of knowledge on the subject and the newness of the technology created skepticism amongst officials and citizens alike.

Nuclear Power Distrust Today

There is still a relatively high level of public distrust of nuclear power today. Forty years after the Three Mile Island accident, Americans disagree on nuclear power's role in our energy future. According to Reinhart, "Forty-nine percent of U.S. adults either strongly favor (17%) or somewhat favor (32%) the use of nuclear energy to generate electricity, while 49% either strongly oppose (21%) or somewhat oppose (28%) its use" (2019). Some researchers assert there is correlation between the public's opinion on nuclear power and nuclear weapons (Baron & Herzog, 2020). The connection to the world's deadliest weapon results in a negative perception of nuclear power. Those that do not support nuclear power also "point to construction costs and safety concerns such as waste storage as drivers of skepticism" (Baron & Herzog, 2020). According to Baron & Herzog, "American public attitudes mirror the downward trend in reactor construction and have remained lukewarm since the 1970s amid environmental, security, and economic critiques" (2020). This extended unwavering public opinion implies that distrust is not attached to a public memory but rather is caused by some set of common grievances that must be addressed to affect change.

Nuclear Power Distrust & Perceived Risk

The distrust of nuclear power in the US is disproportionate to its inherent risk. Nuclear power has been around since December of 1951 and since "there have been about 30 incidents and accidents" globally (Fast Reactor Technology, 2020; IAEA, 2016). Of those 30, all but three

were minor and low risk. The three major nuclear accidents are “the Three Mile Island accident (1979), the Chernobyl accident (1986) and the Fukushima Daiichi accident (2011)” (IAEA, 2016). The worst of these by far is Chernobyl where “A total of 31 people died because of the accident, and about 140 suffered various degrees of radiation sickness and radiation-related acute health impairment” (Chernobyl, 2002). However, “no members of the general public suffered these kinds of effects” (Chernobyl, 2002). The long-term impact of the Chernobyl incident is estimated to be between 4000 deaths (The Chernobyl Forum, 2005) and 60,000 deaths (Fairlie & Sumner, 2006). Analyzing Chernobyl is important because it is the deadliest nuclear accident to occur, and an example the public has used for why nuclear power is excessively risky.

It is important to recognize three key points to understand the risk posed by nuclear power. First, Chernobyl was the worst nuclear accident to ever occur in the 70 years of nuclear power production. An entire industry should not be judged by its worst accident. For example, while hydropower is often considered to be a safe means of energy production, it caused one of the most harmful power-related accidents: “the Shimantan hydroelectric facility failed catastrophically on August 8, 1975, causing more than $9 billion in property damage and 171,000 deaths,” many more than Three Mile Island and Chernobyl (Sovacool et al., 2016). Secondly, in 70 years of nuclear power production only 30 incidents have occurred globally, of which only 3 are considered major. Thomas acknowledges the disproportionate perception of the dangers of nuclear power: “public fears far outweigh the risks from civilian nuclear technology, which has seen only a handful of serious accidents in the intervening decades” (2015). The long period of relatively safe power production across many countries must not be discounted. Third, the other sources of energy utilized today cause many more deaths than nuclear power. In many

ways, the risk associated with nuclear power is not just blown out of proportion, it is associated with the wrong energy source.

The energy sources that have a greater risk than nuclear power are the fossil fuels. Of our current energy sources, “fossil fuels are the dirtiest and most dangerous, while nuclear and modern renewable energy sources are vastly safer and cleaner” (Ritchie, 2020). Air pollution caused by fossil fuels are responsible for at least five million deaths annually (Lelieveld et al., 2019). In addition, workplace accidents including “mining and extraction of the fuels” and “the transport of raw materials and infrastructure, the construction of the powerplant; or their deployment” cause fossil fuel-related deaths (Ritchie, 2020). Lastly, fossil fuels resulted in 87% of global CO2 emissions in 2018, contributing to climate change-related deaths due to environmental factors such as increased sea levels, droughts, and flooding (Ritchie, 2020). While deaths related to climate change are only indirectly related to fossil fuel production, it is still important to recognize the role fossil fuels play.

It is estimated that the air pollution from fossil fuels has killed about 100 million people in the last 50 years (Kurzgesagt, 2021). However, fossil fuels provide over 80% of global energy. (Ritchie, n.d.). The ratio of deaths per terawatt-hour of energy production can be calculated to make a conclusion about the relative dangers of different energy sources: Brown Coal – 32.72; Coal – 24.62; Oil – 18.43; Biomass – 4.63; Natural Gas – 2.82; Nuclear – 0.07; Wind – 0.04; Hydropower – 0.02; Solar – 0.02 (Ritchie, 2020). To help put these data into perspective, in a town of approximately 190,000 people would consume about one terawatt-hour of electricity. If this town were run solely on coal, 25 people would die every year, mostly from air pollution related disease. If the town were run solely on nuclear power, “it would take 14 years before a single person would die,” and that may even be an overestimate (Ritchie, 2020). This relative

risk analysis has been understood since the 1980s. Weart acknowledged that "a typical coal-fired plant routinely emitted more radioactive material into the air than a nuclear reactor" and "using coal instead of uranium might cost hundreds of lives each year for each power plant" (1988). Even a renewable source such as hydropower is not without its risks, even though the public perceives it as being safe: "There were dams in the US whose failure could kill a quarter of a million outright. Those who carefully studied possible disasters found that reactors… were not necessarily more dangerous than many forms of industry that the public accepted" (Weart, 1988). This comparison shows how the public distrust of nuclear power and default acceptance of fossil fuels is disproportional, if not backwards, to the actual risk associated with each.

Nuclear Power Distrust Affecting Further Development

Public distrust of nuclear power negatively affects the development of the industry and restrains the transition away from non-renewable energy sources. At the beginning of the nuclear era, Lewis Strauss, Chairman of the US Atomic Energy Commission, predicted: "If the country is well informed and if it knows of our program and approves of it, we will be allotted [enough money] ... to operate it. If the country is uninformed or misinformed, we would feel it quickly" (1954). Today, an under informed and misinformed public does not popularly support nuclear power, while the evidence supporting its relative safety and environmental compatibility abounds.

This distrust has resulted in regulatory ratcheting, which is "the retroactive extension and application of government regulations that apply to licensed nuclear power construction" (Taylor et al., 2012). This system was made possible by a dual-step licensing requirement, "which allowed society's perception of the risks associated with nuclear plant operation to impact

nuclear plant construction" (Taylor et al., 2012). According to Cohen, "Regulatory ratcheting was driven not by new scientific or technological information, but by public concern and the political pressure it generated" (1990). In the time it took to build a plant after receiving the primary construction license, new regulations had been established. Upon completion, the new plant would have to meet the new regulations to acquire an operating license, effectively rendering the initial license pointless (Taylor et al., 2012).

The problem is regulatory ratcheting is expensive. Cohen estimates that regulatory ratcheting "quadrupled the cost of nuclear power plants" by "increasing the quantity of materials and labor going into a plant" as well as increasing "costs by extending the time required for instruction" (1990). Nuclear plant planning time was "16 months in 1967, 32 months in 1972, and 54 months in 1980" while build time "increased from 42 months in 196, to 54 months in 1972, to 70 months in 1980" (Cohen, 1990). This resulted in a total construction time increase "from 7 years in 1971 to 12 years in 1980" (Cohen, 1990). The significant increase in construction time not only cost more money for the nuclear power industry; it also resulted in more electricity being produced via fossil fuels instead of nuclear, which cost lives.

After the Three Mile Island incident, the resulting public distrust significantly affected the nuclear industry thanks to regulatory ratcheting: "That accident effectively halted the expansion of nuclear power in the U.S., with no new plants constructed for 30 years after the partial meltdown at TMI" (Reinhart, 2019). The public distrust sparked more regulatory ratcheting, driving up costs and stopping the progress of the industry in its tracks. Three Mile Island is the most distinct example in the United States of public distrust directly causing overburdening regulations that impact the progress of the industry.

Today, the nuclear industry faces new challenges that it did not a few decades ago, due to the breakdown of nuclear plants: “Many of the country's existing nuclear power stations are potentially approaching the end of their service lives and the industry faces pressure from organized opposition to the use of nuclear power as well as competition from cheaper energy alternatives such as natural gas” (Reinhart, 2019). In the last twenty years, fifteen commercial power reactions have been shut down (Baron & Herzog, 2020). The US’s reactors are going offline, and they are not being replaced fast enough to compensate for the loss. Smith points out that “public perception of nuclear safety can change swiftly despite a country’s long history of safely operating nuclear power plants” (2015). Monitoring the public perception of nuclear safety is essential: “The public’s trust, acceptance, and involvement in nuclear regulatory decisions, therefore, are critical to a successful nuclear power program” (Smith, 2015). Diffusing public opposition and increasing active support of nuclear power is essential to overcoming these challenges to keep nuclear relevant in the US energy portfolio. The established public distrust of nuclear power has and does negatively affect the development of the industry through regulations based in popular opinion and politics instead of scientific fact.

Public distrust of nuclear power has and does influence policies and regulations that are applied to the nuclear industry. The foundation for distrust was built in the 1950’s and has grown through the decades, where today half of the country is opposed to nuclear power (Reinhart, 2019). By altering these generally held opinions, nuclear power may again become a possibility of the future and the answer to climate change. How do we do this? As Strauss puts it, “the future of the scientists’ America, and yours and mine, lies fundamentally with education – that which is taught to the young in our schools – that which is taught throughout life in the media of general communication by the contemporary writers” (1954). Educating the public on

nuclear power and the risks associated with it and other energy sources is essential to changing the opinions of half the nation and putting the U.S. on the path towards fixing the planet.

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