The U.S. Nuclear Energy Debate

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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The competition to influence the expansion of U.S. nuclear energy centers around the relationships between the nuclear power industry, U.S government oversight committees, U.S. political administrations, energy interest groups, and American public opinion. Originally pursued for its economic viability, increased public demand for carbon-free energy, combined with nuclear power's low carbon emissions, make it a contender to replace fossil fuels, and many see nuclear energy as a "major component of our rescue" from the ongoing climate crisis (Yale). The World Nuclear Association found that nuclear energy would have reduced carbon emissions by 1,959 million tons had it been used in place of fossil fuels in 2018 (World Nuclear Association, 2019). However, the waste produced by nuclear reactors "remain[ing] dangerously radioactive for thousands of years," catastrophes such as the 2011 Fukushima Daiichi disaster that killed 1,368 people, and decreasing costs for other low-emission energy such as renewables, have damaged confidence in nuclear power (Tokyo Shimbun, 2016). How researchers can demonstrate the advantages or hazards of nuclear energy in comparison to competing forms of energy to the public, legislators, regulators, and industry is the primary mechanism that has shaped the U.S. nuclear power policy.

History of U.S. Nuclear Energy

The Atomic Energy Act of 1946 catalyzed American exploration into non-military uses of nuclear technology by establishing the Atomic Energy Commission (AEC), a federal commission tasked with both overseeing American exploration of nuclear power. Although practical implementations of nuclear reactors were not fully developed at this time, the Atomic Energy Act recognized discovering peaceful uses of nuclear technology would "cause profound

changes in our present way of life" (Atomic Archive, para. 3). In 1957, an amendment to the Atomic Energy Act was passed that allowed the AEC to "make grants and contributions to the cost of construction and operation of reactors," and to evaluate what classified information "can be published without undue risk to the common defense and security," to give the nuclear industry access to the financial and informational resources they needed to expedite reactor development (Nuclear Regulatory Commission 2013, pg. 83).

This link established between private industry and the U.S. government by this amendment led to the construction of the first nuclear reactor in the world, the Shippingport Atomic Power Station. This reactor began producing electricity in 1957, and marked the beginning of the U.S. nuclear energy industry (ASME, para. 3). The Price-Anderson Act was passed in the same year, which established a fund to compensate "members of the public who incur damages from a nuclear or radiological incident no matter who might be liable" (American Nuclear Society, 2005, pg. 1). Under this act, private operators of nuclear power plants would only be liable for up to 560 million dollars of damage before the fund was utilized (Temples, 1980). This fund's removal of a major financial "deterrent to private sector participation in nuclear activities" increased investment into nuclear energy, but was also a U.S. government admission of the inherent risks of operating reactors (ANS, 2005, pg. 2).

By the time the Shippingport plant ceased operations in 1989, nuclear energy had grown into the second largest source of power in the U.S. behind coal, with 109 reactors "generating about 19 percent of the nation's electricity" (Duke Energy, 2012, para. 3). While this era saw high growth for nuclear power, "the events at Three Mile Island (Pennsylvania) and Chernobyl (Ukraine) in 1979 and 1986, respectively, raised concerns about the safety of nuclear power and fueled anti-nuclear dissenters" (DE, 2012, para. 4). In the decades that followed these incidents,

the U.S. government has found it harder to convince the public of nuclear energy's viability, and the proportion of electricity generated by nuclear reactors in the U.S. has only increased to 20 percent since then (WNA, 2020). The Energy Policy Act of 2005 passed by the Bush administration (The White House, 2005) and the Obama administration supporting "the first new nuclear power plant in three decades" (Politifact, 2012) marked a potential resurgence of support for nuclear energy, but much of this momentum was lost in 2011 as a result of the Fukushima disaster.

Review of Research

James Temples' 1980 article "The Politics of Nuclear Power: A Subgovernment in Transition" contends that the relationship between the U.S. federal government and the nuclear industry had developed into what he calls a "subgovernment" responsible for influencing nuclear policy independent of public opinion (Temples, 1980). Subgovernments are defined by Temples as "closed and autonomous alliances of political actors" focusing on a single policy area that consist of "an executive branch agency; the executive branch agency's clientele groups (the interest groups that benefit directly from the programs administered by the agency); and the specialized authorizing and appropriations committees and subcommittees that oversee the agency's budget and programs". Temples claims the "groundwork was laid" for the U.S. nuclear energy subgovernment in the years 1946-1954 through the interactions of the AEC, the Joint Committee on Atomic Energy (JCAE) that oversaw the AEC, and a General Advisory Committee (GAC) of nuclear scientists.

In the early years of nuclear energy development, the AEC and JCAE's lack of "technical expertise in a new and complex field" made them "cautious and self-restrained in exercising their

authority," leading them to rely on the GAC to formulate the majority of nuclear policy. The Soviet Union's first successful nuclear weapon test in 1949, "three years earlier than the GAC had predicted," strained the relationship between the JCAE and the AEC/GAC. The "politically charged atmosphere of the Cold War" led the JCAE to be more assertive with their authority over the AEC. After a JCAE investigation of the AEC uncovered "mistakes and lax security procedures," then AEC director David Lilienthal resigned, increasing JCAE's influence over the AEC. Public opinion was not a large factor in early nuclear energy policy. Instead, Cold War-era political pressure, international events, and committee conflicts determined policy direction.

The Brookings Institute's 2004 report "The Political Economy of Nuclear Energy in the United States" examines the economic and political realities that shaped nuclear policy of the time (Nivola). The Brookings Institute found "the electricity produced by operational nuclear plants in the United States tends to be cost competitive with gas or coal-generated power after the plants have been paid for." Reactors not yet built were less competitive with traditional energy sources, sitting at 6.7 cents per kilowatt-hour in comparison to coal's 4.3 cents per kilowatt-hour. Lowering plant construction time to "four or five years, and lowering construction costs by a quarter, would still not put the plants in contention with coal." The report contends that these costs cannot be examined in a vacuum, and that the interference of the federal government, for better or worse, could dramatically shape the competitiveness of nuclear energy. The Brookings Institute claims "the entire nuclear food-chain, from research and development and fuel supply services to liability insurance, waste disposal, and eventual decommissioning, has been backed in one way or another by government policies."

The Brookings Institute contends that the struggle between nuclear energy proponents and regulators stems from "cumbersome regulatory hurdles, most notably the need to obtain

from the Nuclear Regulatory Commission (NRC) separate approvals for constructing and then operating a new reactor." The Energy Policy Act of 1992 ended this two-approval process and afforded nuclear reactor development more freedom to create new plants. While regulatory push and pull between the federal government and the nuclear power industry will likely continue, the Brookings Institute argues "eccentric government policies, including environmental ones, have not been the overriding source of the nuclear industry's tribulations." Instead, Brookings sees "four fundamentals [that] continue to dampen enthusiasm for a nuclear renaissance in the United States," being annual growth in demand for power remaining low, the competitiveness of gas-fired technology in comparison to nuclear energy, the lack of economic incentives to retire coal as the main U.S. energy source, and the large number of reactors already operating in the U.S.

The U.S. Nuclear Energy Debate

The Bulletin of the Atomic Scientists claims that public opinion of nuclear power is "highly changeable and easily influenced," resulting from most Americans lacking expertise on the subject (Bulletin of the Atomic Scientists, 2018). A Nuclear Energy Institute survey found 54 percent of Americans who designated themselves as being "very well-informed" about nuclear power "strongly favored" it as a source of energy. In contrast, only 7 percent of those who designated themselves as being "not well-informed at all" strongly favored nuclear energy (Nuclear Energy Institute, 2016). Because of this correlation between being informed and favoring nuclear energy, proponents of nuclear energy focus their resources into educating the public to improve public opinion of nuclear energy. However, "informing the public" can take on many forms. Publishing research focusing solely on the dangers of nuclear power, versus

publishing research outlining its environmental benefits will result in different shifts in public opinion.

The Office of Nuclear Energy (NE), which operates under the U.S. Department of Energy, states their mission is to "advance nuclear power to meet the nation's energy, environmental, and national security needs" (Office of Nuclear Energy). While this mission could conceivably be achieved without transparency regarding their actions, NE's website instead features numerous articles showcasing the viability of nuclear power such as "5 Problems You Didn't Know Nuclear Could Solve" (NE, 2019) or "11 Reasons Why DOE is All in on New Nuclear" (NE, 2019). Titles like these sound like something one would expect from their Facebook feed, not a government agency. However, perhaps by avoiding technical language and titling their articles in an accessible and even "clickbaity" way, NE believes they can draw more attention to their research. There's no shortage of technical research related to nuclear energy, but presenting that research in a way that engages the public is the true test of participants' abilities to influence change.

Operators of nuclear power plants focus on demonstrating the economic benefits of nuclear power in the communities where reactors are built. Power company Dominion Energy's website features statistics on how the three nuclear plants it operates benefit local economies. Dominion Energy's Milstone plant "produces over $1.5 billion in annual economic benefits to Connecticut, supports almost 4,000 jobs, generates the equivalent of over half the electricity consumed in Connecticut, generates 98 percent of the state's carbon-free electricity, while preventing 8.3 Million metric tons of CO2 from being released each year" (Dominion Energy). The North Anna and Surry power plants in Virginia power 870,000 homes, support 1800 jobs, and produce 31 percent of Virginia's electricity (DE). While the provided statistics also include

carbon-emission reduction data, it is clear the focus of Dominion Energy is to convince people who don't see climate change as a serious threat that nuclear power can revitalize local economies by providing employment opportunities and cheap electricity.

Opponents of nuclear energy take a twofold approach in engaging nuclear energy by both highlighting its risks, and supporting its alternatives. Environmentalist group Friends of the Earth (FOE) highlighted risks regarding the closed San Onofre nuclear power plant in California, which contains "one of the largest concentrations of radioactivity in the United States," in their 2013 report "Reducing the hazards of high-level radioactive waste in Southern California: Storage of nuclear waste from spent fuel at San Onofre" (Friends of the Earth). According to this report, 1099 tons of nuclear waste is currently stored in two reactor pools at San Onofre, which is "three times more long lived radioactivity than is stored in some 177 defense high-level radioactive tanks at the U.S. Department of Energy's Hanford site in Washington" . Because the plant is located in an area vulnerable to earthquakes, damage to the reactor pools resulting in water loss would lead to approximately "86 million curies of radioactivity" being released into the atmosphere, a lethal dose "to people living within a 10-mile radius" (Alvarez, 2013) FOE's publicizing of the risk associated with irresponsible handling of nuclear waste damages nuclear power's reputation with the public, but can also signal industry to take steps to fix their mistakes.

Environmental news site EcoWatch's 2019 article "Nuclear Power Is Economically Obsolete" argues that nuclear energy has been taken over by renewables as the solution to climate change, and questions "whether nuclear power is needed at all" (EcoWatch, 2019). To support this claim, EcoWatch quotes an interview conducted by energy industry trade journal POWER with Peter Bradford, formerly of the Nuclear Regulatory Commission. In this interview, Bradford argues that in terms of economic viability, "new nuclear is so far outside the

competitive range" compared to renewables, and that "not only can nuclear power not stop global warming, it is probably not even an essential part of the solution to global warming" (POWER, 2019). EcoWatch also references a 2018 Stanford study that estimated future costs of nuclear versus renewable energy in New York. Stanford concluded New York using wind-generated energy in place of nuclear would have "the lowest overall system cost ($24.5 billion) and CO2 emissions" (Cebulla & Jacobson, 2018). EcoWatch's article illustrates how interest groups can organize data supporting their viewpoints into a concise form to persuade the public of their agenda, without necessarily having to conduct any formal research of their own. Independent researchers without clear agendas for or against nuclear power can have their work used by more strongly opinionated groups to support their agendas.

Examining participant responses to critical incidents, such as the 2011 Fukushima disaster, sheds light on their agendas. The Union of Concerned Scientists (UCS), a nuclear proponent, was on the defensive after Fukushima and responded by framing the incident as a tragic signal that the U.S. must strengthen its nuclear reactor safety measures. In 2011, UCS issued "Fukushima FAQs" (Frequently Asked Questions), a technical analysis of the cause and effects of the disaster, and its lessons to the U.S.. UCS highlighted flaws in U.S. reactor design, and warned that U.S. reactors can handle "power outages lasting only four hours," and dozens of them "have operated for years in violation of federal fire protection regulations." According to UCA, a nuclear reactor incident is assumed to "be the only demand on emergency response resources" under current emergency protocols (UCS, 2011). While UCS' response was defensive, Greenpeace continued to advance their vision for a world powered by renewables.

A year after the Fukushima disaster, Greenpeace issued "Lessons from Fukushima," which claims the disaster "marks the end of the nuclear safety paradigm" and shows a "deep and

systemic failure" of those responsible for ensuring nuclear reactor safety. Greenpeace contends, the idea of nuclear safety does not exist, and that "there are only nuclear risks, inherent to every reactor." Greenpeace capitalized on the public anxiety caused by Fukushima in order to insist with finality that "dangerous" nuclear power must be phased out and replaced with "mature, robust and affordable renewable energy technologies… that are available and up to the task of replacing hazardous nuclear reactors" (Morris-Suzuki, 2012). In contrast UCS' defensive response to the incident, Greenpeace received an opportunity to advance their vision for a world powered by renewables.

Politics play an important role in the future of U.S. nuclear energy. Although support for nuclear energy is not split evenly across Republican and Democratic party lines, the nuclear energy views of the president currently in office can drastically affect its progress. Remaining potential presidential nominees in the 2020 Democratic Primary Joe Biden and Bernie Sanders' views on nuclear power are in direct contrast to one another, despite them sharing the same political party. Biden sees nuclear energy "as an essential zero-carbon energy source," specifically favoring the development of "small modular nuclear reactors at half the construction cost of today's reactors" (Biden). In contrast, Sanders' proposed "Green New Deal" would 'stop the building of new nuclear power plants and find a real solution to our existing nuclear waste problem," and also "enact a moratorium on nuclear power plant license renewals in the United States to protect surrounding communities" (Sanders). Assuming each candidate would use their executive powers to fully enact their respective plans, the future of nuclear energy would look vastly different under a Biden versus a Sanders presidency. However, candidates' opinions on nuclear energy is far from the most important issue to the majority of voters. A 2020 Gallup poll ranking the importance of various issues to voters had nuclear energy not even making the list,

unless you place it under the category of “climate change,” in which case it becomes the seventh most important issue to American voters (Hrynows, 2020). Despite having such a small impact on how Americans vote, election results can drastically affect the future of nuclear energy.

Current president Donald Trump’s administration has beens supportive of expanding U.S. nuclear energy infrastructure, in particular by passing of the Nuclear Energy Innovation Capabilities Act (NEICA), which “eliminates some of the financial and technological barriers standing in the way of nuclear innovation,” (Department of Energy, 2018) and proposing a 2021 budget which allocates $1.2 billion “nuclear energy research and development and related programs” (Calma, 2020). It is unlikely that this push to expand U.S. nuclear energy by the Trump administration is for the sake of the climate, as the administration has also extended help to the coal industry through the Affordable Clean Energy rule, which replaced the Obama administration’s Clean Power Plan “with a rule that restores rule of law, empowers states, and supports energy diversity” by encouraging states to “ limit carbon dioxide (CO2) at their coal-fired electric generating units” without phasing out the industry (Environmental Protection Agency, 2019). The Trump administration's support of nuclear energy comes strictly from the angle of economic viability, as the administration's support of the coal industry demonstrates reducing carbon emissions is not their priority.

Assuming Donald Trump will be competing against Joe Biden for the presidency in 2020, which seems likely considering FiveThirtyEight currently shows Biden having a 98 percent chance of securing the Democratic nomination, the future of U.S. energy looks promising (FiveThirtyEight, 2020). It is safe to assume if Trump is re-elected in 2020 that his administration will continue to push for the development of new nuclear energy technology, and Biden similarly has his own plans for the expansion of nuclear energy. Whether or not there will

be a difference in how the two administrations will exercise their executive power to implement their agendas remains to be seen.

Conclusion

Proponents and opponents of nuclear power compete to inform and persuade the public and policy makers on whether it can or cannot be trusted as a safe, reliable and sustainable source of power for the U.S.. Nuclear power's future depends also on how quickly lower risk alternatives such as renewable energy become cheaper. Participants in this battle for the future of American energy must have a comprehensive understanding of both nuclear and renewable energy technologies, and how to influence policy makers.

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