

Background

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Competitive Nuclear Energy Investment: Avoiding Past Policy Mistakes

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Nuclear power is a proven, safe, affordable, and environmentally friendly alternative to fossil fuels. It can generate massive quantities of electricity with almost no atmospheric emissions and can offset America's growing dependence on foreign energy sources. The French have used it to minimize their dependence on foreign energy, and at one time the United States was on the path to do the same.

However, the commercial nuclear energy industry in the U.S. is no longer thriving. Investors hesitate to embrace nuclear power fully, despite significant regulatory relief and economic incentives.

This reluctance is not due to any inherent flaw in the economics of nuclear power or some unavoidable risk. Instead, investors are reacting to the historic role that federal, state, and local governments have played both in encouraging growth in the industry and in bringing on its demise. Investors doubt that federal, state, and local governments will allow nuclear energy to flourish in the long term. They have already lost billions of dollars because of bad public policy.

The United States once led the world in commercial nuclear technology. Indeed, the world's leading nuclear companies continue to rely on American technologies. However, in the 1970s and 1980s, federal, state, and local governments nearly regulated the U.S. commercial nuclear industry out of existence. U.S. companies responded by reallocating their assets, consolidating or selling their commercial nuclear capabilities to foreign companies in pro-nuclear countries.

Talking Points

- Nuclear power is a proven, safe, affordable, and environmentally friendly alternative to fossil fuels that can generate massive quantities of electricity with almost no atmospheric emissions and offset America's growing dependence on foreign energy sources.
- Investors are hesitant to embrace nuclear power fully because they doubt that federal, state, and local governments will allow nuclear energy to flourish in the long term.
- Anti-nuclear activists understood that they could kill the industry by turning public opinion—and therefore a democratic government—against nuclear power.
- Regulation increased the cost of constructing a nuclear power plant fourfold. This cost escalation was largely a function of anti-nuclear activism, agenda-driven politicians, activist regulators, and unsubstantiated public fear.
- Overregulation largely destroyed the nuclear industry and is still an obstacle to investment in the industry.

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This paper reviews how overregulation largely destroyed the nuclear industry and why it remains an obstacle to investment in the industry. This dynamic must be understood and mitigated before the true economics of nuclear power can be harnessed for the benefit of the American people.

Private Investors in U.S. Industry

Private investors have a key role to play in reestablishing America's nuclear industry. The industry is no longer owned or supported by the government, although the Energy Policy Act of 2005 does provide some incentives to utilities. In general, private investors provide the capital and take the risks necessary to develop the nuclear industry. The government's role should be to ensure safety and allow the industry—just like any other—to compete and flourish in open markets.

The heavy regulatory burden imposed on the nuclear industry creates enduring uncertainties about the future of nuclear power in the United States. While a strong public commitment does provide some near-term certainty, it still is accompanied by regulatory and investment uncertainty. This does little for the long-term planning inherent in nuclear energy, which results in higher risk assessments for America's energy companies.

Investors are right to be wary. Anti-nuclear activists have already exploited the authority of public institutions to strangle the industry. Now these same public institutions must be trusted to craft good public policy that reestablishes the confidence necessary to invite investment back into America's nuclear industry. To be successful, the new policies must create an industry that does not depend on the government. They must mitigate the risks of overregulation but allow for adequate oversight while preventing activists from hijacking the regulatory process.

Dependence and Vulnerability

The federal government heavily promoted nuclear power throughout the industry's rise in

the 1950s and 1960s. The government essentially picked nuclear energy as a winner to supply America's energy needs. This public commitment attracted significant private investment during the industry's growth phase. Investors made decisions based on, among other variables, an expectation that the government would not suddenly turn against nuclear power.

The United States spent decades encouraging the private sector to invest in peaceful nuclear energy. This effort began with the Atomic Energy Act of 1954, which gave industry easy access to nuclear technology that was originally developed for national security reasons, and included the creation of follow-on public-private partnerships such as the 1955 Power Demonstration Reactor Program. The federal government worked with industry on a host of military, civil, and commercial projects throughout the 1950s and 1960s. Under the auspices of the Atomic Energy Commission in the executive branch and the Joint Committee on Atomic Energy in Congress, the government provided lucrative guaranteed contracts and other subsidies that protected investments and assured private-sector access to the latest nuclear technology.¹

The peaceful use of the atom, it was claimed, was the answer to future energy woes because it would produce electricity that, among other advantages, was "too cheap to meter."² The U.S. Navy's desire to expand nuclear propulsion in its fleet also heavily influenced growth in the private sector. Although direct subsidies, such as rapid tax amortization and funding for reactor construction, stopped in the late 1960s, entities within Congress and the executive branch continued to promote nuclear power with indirect support, such as market guarantees and access to technology.³

Private investment followed Washington's lead. In cooperation with the federal government, the private sector expanded capacity and capabilities and developed the necessary technology. Public policy effectively harnessed the power of the private

1. Lee Clarke, "The Origins of Nuclear Power: A Case of Institutional Conflict," *Social Problems*, Vol. 32, No. 5 (June 1985), p. 476.
2. "Abundant Power from Atom Seen: It Will Be Too Cheap for Our Children to Meter, Strauss Tells Science Writers," *The New York Times*, September 17, 1954, p. 5.
3. Clarke, "The Origins of Nuclear Power," p. 479.

sector to advance national objectives. The result was the emergence of a world-class nuclear industry.

However, the nuclear industry's success was due largely to public policy designed to promote its growth. Although the industry grew, it became overly dependent on government. This left it vulnerable to shifts in public policy. When policy shifted toward outright opposition as the activist community convinced America's political left that nuclear power was dangerous, the industry predictably failed as investors cut their losses and moved capital to opportunities that were perceived as less threatened by increasing regulatory volatility.

Anti-nuclear activists understood that they could kill the industry by turning public opinion—and therefore a democratic government—against nuclear power. This process began in the early 1970s. Although other factors such as rising interest rates, recession, and economic chaos caused by the oil crisis contributed to the nuclear industry's deterioration, the growing regulatory burden was paramount.

Activists Gone Wild

Anti-nuclear groups used both legal intervention and civil disobedience to impede construction of new nuclear power plants and hamper the operations of existing units. They legally challenged 73 percent of the nuclear license applications filed between 1970 and 1972 and formed a group called Consolidated National Interveners for the specific purpose of disrupting hearings of the Atomic Energy Commission.

Much of the anti-nuclear litigation of the 1970s was encouraged by factions within the government.⁴ Today, activist organizations determined to force the closure of nuclear power plants, such as Mothers for Peace, continue to use the legal process to harass the nuclear energy industry.

Activists went well beyond simply challenging nuclear power in the courts. On numerous occasions, demonstrators occupied construction sites, causing delays. For instance, in May 1977, the Clamshell Alliance led a protest that resulted in the arrest of more than 1,400 people for trespassing at the Seabrook plant site in New Hampshire.⁵ In California, the Abalone Alliance adopted similar tactics and frequently blocked the gates of the Diablo Canyon power plant.⁶

A watershed victory for the anti-nuclear movement occurred in 1971 when a federal appeals court ruled that the construction and operating permits for a nuclear power plant violated the National Environmental Policy Act of 1969. As a result, utilities were required to hold public hearings before obtaining a permit to start a project.⁷ This decision created a major opening in the process that anti-nuclear activists could exploit.

Changing the Economics of Nuclear Power

The public-private relationship worked until nuclear power began to fall out of favor with public officials in the early 1970s. This, in part, led to bureaucratic restructuring in the legislative and executive branches.

- In Congress, the Joint Committee on Atomic Energy was disbanded, and oversight responsibility for nuclear activities was transferred to multiple committees. This led to decentralized oversight and a weakening of nuclear policy in Congress. It also provided additional avenues for anti-nuclear lobbyists to influence Congress.
- In the executive branch, the Atomic Energy Commission, which both advocated for and oversaw the nation's nuclear activities, was replaced by the Nuclear Regulatory Commission (NRC), which was given the sole function of regulating the nuclear industry.

4. Elizabeth H. Boyle, "Political Frames and Legal Activity: The Case of Nuclear Power in Four Countries," *Law & Society Review*, Vol. 32, No. 3 (1998), pp. 149 and 151.

5. Steven E. Barkan, "Strategic, Tactical and Organizational Dilemmas of the Protest Movement Against Nuclear Power," *Social Problems*, Vol. 27, No. 1 (October 1979), p. 24.

6. Energy Net, "The Abalone Alliance Story," at www.energy-net.org/01NUKE/AA.HTM (November 2, 2007).

7. Elliot Blair Smith, "Nuclear Utilities Redefine One Word to Bulldoze for New Plants," *Bloomberg.com*, September 25, 2007, at www.bloomberg.com/apps/news?pid=20670001&refer=home&sid=ag_TpOMlk0Xw (October 1, 2007).

In addition, the role of the judiciary cannot be overemphasized. Congress's loss of enthusiasm for nuclear energy led to more aggressive regulation, and because jurisdiction over nuclear issues was divided among multiple committees, there was no unified congressional direction. The result was an expansion of costly and often unnecessary rules.

In June 2006, the NRC listed over 80 sources of regulation,⁸ including over 1,300 pages of laws, treaties, statutes, authorizations, executive orders, and other documents. In addition to obvious legislative efforts, such as the Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974, nuclear activities in the United States must comply with the Inspector General Act, the Clean Air Act of 1977, the Federal Water Pollution Control Act of 1972, and the National Environmental Policy Act of 1969, to name a few of the other applicable laws.

This created numerous opportunities for anti-nuclear groups to file noncompliance suits. Whether or not the groups' concerns were legitimate, regulators often responded with additional mandates, which were very easy to establish. A regulator could compel a change in plant design simply by deciding that it would add substantially to public health or safety. The problem was that NRC statutes did not define "substantial." Because the interpretation of NRC regulations was left to the discretion of individual NRC technical reviewers, each license application would often result in its own unique requirements.⁹

This inconsistency increased costs, further souring Congress on nuclear power and leading to an endless spiral of legislation, regulation, and still more added costs. Between 1975 and 1983, 430 suits were brought against the NRC, leading to

2,349 proposed rules and regulations—each of which required an industry response.¹⁰ The additional and unexpected controls created industry-wide uncertainty and raised questions about the long-term economics of nuclear power. They also drove up capital costs.¹¹

This was all done by the NRC without adequate information. The NRC recognized as early as 1974 that it was issuing regulations without sufficient risk assessment training or cost considerations. It did not even have a program to train employees in how to conduct a review using NRC guidance.¹² Yet the commission continued to issue regulation after regulation.

At the same time, state and local governments expanded their oversight functions. States often claimed jurisdiction over construction and operations permits as well as environmental regulation. For example, while the Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, the Clean Air Act, and the Solid Waste Disposal Act mandated that states enforce minimal federal environmental standards, many states chose to adopt additional regulations.¹³ Environmental standards that varied from jurisdiction to jurisdiction imposed additional costs and opened additional avenues for anti-nuclear activists to exploit.

Today, many states exercise significant authority over the location and construction of nuclear reactors. Some jurisdictions have outright moratoria on new nuclear construction. For example, California prevents further construction of nuclear power plants until both the California Energy Commission and the federal government approve a method of disposing of nuclear waste. Most states that limit construction of nuclear plants use some variation of

8. U.S. Nuclear Regulatory Commission, *Nuclear Regulatory Legislation: 109th Congress*, Vol. 1, No. 7, Rev. 1, 2nd Sess., and Vol. 2, 1st Sess., June 2006, at www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0980 (October 29, 2007).

9. U.S. General Accounting Office, *Nuclear Powerplant Licensing: Need for Additional Improvements*, EMD-78-29, April 27, 1978, p. 14, at <http://archive.gao.gov/f0902b/105656.pdf>.

10. Magali Delmas and Bruce Heiman, "Government Credible Commitment to the French and American Nuclear Power Industries," *Journal of Policy Analysis and Management*, Vol. 20, No. 3 (Summer 2001), p. 447.

11. For a full analysis of this phenomenon, see *ibid.*, pp. 433-546.

12. U.S. General Accounting Office, *Nuclear Powerplant Licensing*, pp. 17-21.

13. U.S. General Accounting Office, *Electric Power: Contemporary Issues and the Federal Role in Oversight and Regulation*, EMD-82-8, December 21, 1981, p. 28, at <http://archive.gao.gov/d47t13/117098.pdf>.

this theme.¹⁴ Public commissions and referenda can impose additional restrictions.

The shifting regulatory environment gave rise to additional reviews from numerous public institutions. Once permits were obtained, additional design changes were often mandated—even during construction. This inefficient and time-consuming process increased the time required to build a nuclear power plant by 42 percent (from 86 months to 122 months) between 1966 and 1970. From 1974 to 1984, the average construction delay was nearly 40 months, and between 1956 and 1979, the average construction permit review time increased fourfold. The average time required to bring a plant on line from the order date increased from three years to 13 years during a similar time period.¹⁵ This significantly increased both the cost of a plant and the risks to the investors financing these projects. In addition, as the need for electricity increased, lengthy delays further undermined public confidence in the viability of nuclear power.

During the 1970s, regulatory mandates also drastically increased the quantity of materials required to build a plant. Steel requirements increased by 41 percent, concrete by 27 percent, piping by 50 percent, and electrical cable by 36 percent. Even though experience demonstrated that these increases were unnecessary to maintain safe operations, regulatory relief never followed.¹⁶ In some instances, builders even added safety features that were not mandated in hopes of avoiding further stoppages.

As more inspections and inspectors were required, delays often resulted from inadequate regulatory manpower. Workers had to spend inordinate amounts of time waiting for inspections rather than building the project. The oft-changing construction specifications also led to mistakes, which created further delays.

Even after construction was complete, delays often continued. Delaying plant completion could cost up to \$1 million per day.¹⁷ Stories of costly and unnecessary delays litter the history of U.S. nuclear power. Plants such as the Shoreham nuclear plant on Long Island were completely built but never used because extremists succeeded in scaring the public and political leaders.

From 1981 to 1988, operations and maintenance costs increased by 80 percent, and 30 to 60 percent of this increase was the direct result of NRC regulation.¹⁸ High interest rates during the 1970s meant that long delays significantly increased project costs as rising interest payments drove up the cost of capital. High inflation drove up the costs of materials. Furthermore, plants were sometimes completed and ready to start producing electricity but were not allowed to begin operations for one regulatory reason or another. This prevented financiers from collecting on their investment. These higher costs were passed on to investors as investment losses and to consumers in higher electricity rates. Neither could be sustained over time when other alternatives, such as natural gas, existed.

Overregulation Leads to a Declining Industry

Overall, regulation increased the cost of constructing a nuclear power plant fourfold.¹⁹ Such cost escalation would have been justified if it had been rooted in scientific and technical analysis. Regrettably, it was largely a function of anti-nuclear activism, agenda-driven politicians, activist regulators, and unsubstantiated public fear. A total of \$70 billion was added to the cost of nuclear reactors constructed by 1988, and this cost was passed on to the ratepayers. After 1981, the cost of constructing a nuclear power plan rose from two to six

14. For a state-by-state analysis of state nuclear policy, see E. Michael Blake, "Where New Reactors Can (and Can't) Be Built," *Nuclear News*, November 2006, pp. 23–25.

15. Delmas and Heiman, "Government Credible Commitment," pp. 450–551.

16. Bernard L. Cohen, *The Nuclear Energy Option* (New York: Plenum Press, 1990), Chap. 9, at www.phyast.pitt.edu/~blc/book/chapter9.html (October 10, 2007).

17. *Ibid.*

18. Delmas and Heiman, "Government Credible Commitment," p. 454.

19. Cohen, *The Nuclear Energy Option*, Chap. 9.

times,²⁰ which means that either consumers paid significantly more or utilities incurred losses if they did not charge market prices. Neither circumstance was sustainable.

The U.S. government even banned entire commercial technologies outright. In 1977, President Jimmy Carter dealt the U.S. nuclear industry one of its greatest setbacks by issuing Presidential Directive 8 (PD-8),²¹ which forbids reprocessing (recycling) nuclear fuel in the United States. “Closing the fuel cycle,” the term used to describe the recycling of spent nuclear fuel, allows used fuel to be recycled and used again. Regrettably, PD-8 has effectively been U.S. policy ever since. As a result, nuclear fuel is run through U.S. reactors only once, wasting a valuable resource and producing unnecessary amounts of high-level nuclear waste.

Recycling spent nuclear fuel would help the U.S. and the world to reduce the volume of high-level nuclear waste and recover vast amounts of energy that remain in “spent” nuclear fuel even after it has gone through a reactor. Currently, only about 5 percent of the energy is used per volume of fuel. The U.S. does not recycle nuclear fuel, but France, Great Britain, China, and Russia are safely using recycling technology.

With recycling in place, the reemergence of nuclear energy in the U.S. could finally move away from relying so heavily on the proposed Yucca Mountain repository. It would allow for a more reasonable “mixed” approach to nuclear waste, which would likely include some combination of permanent geological storage in Yucca Mountain, interim storage, recycling, and new technologies.

However, establishing economically viable commercial recycling in the U.S. will not be easy. Carter’s unilateral ban had a chilling effect on the domestic nuclear industry, forcing domestic nuclear suppliers to discontinue their activities at the cost of hundreds of millions of dollars. One industry group invested approximately \$500 million in a project that never became operational.²² Another major company spent \$64 million on a facility that never opened.²³ This technology has since been transferred overseas and is being used safely by other countries, such as France and Japan.

With overregulation driving up the cost of nuclear power and the government unilaterally banning critical commercial technologies, the U.S. nuclear industry all but died. From the early 1950s through 1974, 231 nuclear power plants were ordered. Another 15 were ordered by 1977.²⁴ However, no new orders have been placed since 1977, although some of plants ordered by 1977 have since become operational.

Not only did orders stop, but previously ordered plants were cancelled. Of the 246 plants ordered in the U.S., only 104 operate today. Some were never built, others were shut down early, and construction was stopped on many after substantial investments had been made. The result was billions of dollars in losses. For example, the Cherokee plant in South Carolina was cancelled in 1982 after over \$600 million had been invested. In 1983, a group of three utilities cancelled the Zimmer plant in Ohio after investing \$1.8 billion.²⁵ In total, \$30 billion was spent on nuclear plants that were never completed,²⁶ which is more than the value of

20. Christian Joppke, “Decentralization of Control in U.S. Nuclear Energy Policy,” *Political Science Quarterly*, Vol. 107, No. 4 (Winter 1992–1993), pp. 719–720.

21. Jimmy Carter, “Nuclear Non-Proliferation Policy,” Presidential Directive NSC-8, March 24, 1977, at www.fas.org/irp/offdocs/pd/pd08.pdf (November 2, 2007).

22. Nuclear Energy Institute, “Plutonium and Uranium Reprocessing,” *acamedia*, January 2003, at www.acamedia.info/politics/nonproliferation/references/nei_2003.htm (October 9, 2007).

23. U.S. Department of Energy, Office of Scientific and Technical Information, “Plutonium Recovery from Spent Fuel Reprocessing by Nuclear Fuel Services at West Valley New York,” February 1996, at www.osti.gov/opennet/document/purecov/nfsrepo.html#ZZ6 (October 9, 2007).

24. Delmas and Heiman, “Government Credible Commitment,” pp. 433–546.

25. Darryl E. J. Gurley, “Nuclear Power Plant Cancellations: Sunk Costs and Utility Stock Returns,” *Quarterly Journal of Business and Economics*, Vol. 29, No. 1 (Winter 1990), at www.allbusiness.com/public-administration/administration-economic-programs/114347-1.html (October 2, 2007).

most of the companies that are considering new plant orders.

The result is that the United States is no longer a technology leader and does not receive the full benefits of nuclear power as it searches for environmentally friendly, affordable, and accessible sources of energy to meet future energy needs. Conversely, other nations are well positioned to lead the global resurgence in peaceful nuclear power.

This is not to say that the United States should build its nuclear industry according to the French or Russian models, which rely on state ownership and controlled markets. Like the old U.S. nuclear industry, this approach creates an industry that relies on government support for long-term success. The pitfalls of this approach were aptly demonstrated during the 2007 French election when the possibility that nuclear skeptic Ségolène Royal would be elected president of France raised fears about the future of the French nuclear industry.

The Effect on Ratepayers

The near death of the U.S. nuclear energy industry has harmed both investors and consumers. First, ratepayers eventually pay for the increased costs of generating electricity. More important, by removing nuclear energy from America's energy portfolio, anti-nuclear activists have limited the choices available to America's energy producers and consumers. Limiting choice has two inevitable results: higher prices and lower quality.

Without nuclear energy as an option and with coal being frowned upon, utilities started moving toward natural gas power plants. This growing reliance on natural gas has caused electricity prices to follow the volatility of natural gas prices. As demand for natural gas has increased, prices have become even more volatile.

Perhaps more ominously, it positions the United States to increase its reliance on foreign energy significantly. Today, America's energy dependence is

largely a function of foreign petroleum and the transportation sector. The nation gets only about 2 percent of its electricity from oil-fired plants. However, the growing U.S. dependence on natural gas is beginning to exceed domestic supply. This has resulted in increasing natural gas imports. Importing energy is not necessarily a problem if those resources are coming from stable, friendly countries, but foreign natural gas reserves are located largely in many of the same, less predictable countries that have large petroleum reserves.

Regulation Today

Congress and the Administration have cleared many of the regulatory hurdles to new nuclear plant construction. For example, the Energy Policy Act of 1992 allows utilities to combine their construction and operations licenses,²⁷ which should streamline much of the regulatory process. The problem is that no one has tried the procedure yet. The Energy Policy Act of 2005 added billions of dollars in regulatory protection for new nuclear plant construction.²⁸ These provisions should mitigate much of the government-induced risk in the near term. Finally, in 2007, the NRC issued a new rule that will allow some pre-licensing of site preparation activities.²⁹

While these efforts are important first steps, they do not provide for long-term predictability. Instead, they provide confidence that a small number of plants will be built over the next few years. Industry is responding with investments to prepare for meeting that demand. However, realizing the many benefits of nuclear power will require a much broader expansion of the nuclear energy industry. Changing the nation's energy profile will require infrastructure investments on par with what took place during the industry's prime.

Conclusion

The history of civilian nuclear energy in the United States reveals the dangers of overt govern-

26. Joppke, "Decentralization of Control in U.S. Nuclear Energy Policy," p. 719.

27. Energy Policy Act of 1992, Public Law 102-486, Sec. 2801.

28. Energy Policy Act of 1992, Public Law 109-58, Title VI.

29. Smith, "Nuclear Utilities Redefine One Word to Bulldoze for New Plants."

ment promotion of or opposition to any particular technology or industry. When public opinion and government policy shifted against nuclear power, the industry was ill-prepared to survive, investors lost billions, and ratepayers suffered.

The role and potential of nuclear power in the United States are too important to allow it to fall victim to the same mistakes again. Investors must be assured that nuclear power will be allowed to stand

or fall on its own merits. While federal, state, and local governments will have a role to play, especially in building confidence with investors, the best long-term subsidy that they could give the industry is the freedom to succeed.

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