

Nuclear Energy: A Viable Alternative Energy Source?

Stephanie Smith

The depletion of natural resources is a major threat to our society. Americans have looked to alternative sources of energy to solve this crisis. Nuclear energy is one of those alternatives. However, nuclear energy has created its own problem: waste. For more than fifty years, nuclear waste has been piling up in America (Wheelwright, 1988). The problem of nuclear waste continues to go unsolved while nuclear energy continues to be an alternative energy source. How does this continue to happen? It is because the producers of nuclear energy do not bear the costs of nuclear waste disposal. It is the American society as a whole who has been undertaking these costs of nuclear energy. There are two possible outcomes that could result if nuclear energy producers were to bear the cost of nuclear waste disposal. One result is that nuclear energy would be produced at an efficient level that is lower than the current level. The other result would be that nuclear energy would cost more than its benefits. Due to this high cost of waste disposal, nuclear energy would no longer be produced. I believe that in the United States the latter result would occur.

The government's involvement in disposing of nuclear waste has led to an inefficient market for nuclear energy. In order for a market to be efficient, the producers must obtain all of the benefits and bear all of the costs. This is definitely not the case for nuclear energy. The producers are gaining all of the benefits but are definitely not bearing all of the costs. Nuclear waste disposal and all of its effects are a cost of nuclear energy. These costs are not being borne by the producers of nuclear energy, but rather by the United States taxpayers through government funding and subsidies. This is the principal reason behind

the inefficient state of the nuclear energy market. The result of this inefficiency is that too much nuclear energy is being utilized, invariably producing an excessive amount of nuclear waste. This can be seen in the graph (see FIGURE 1).

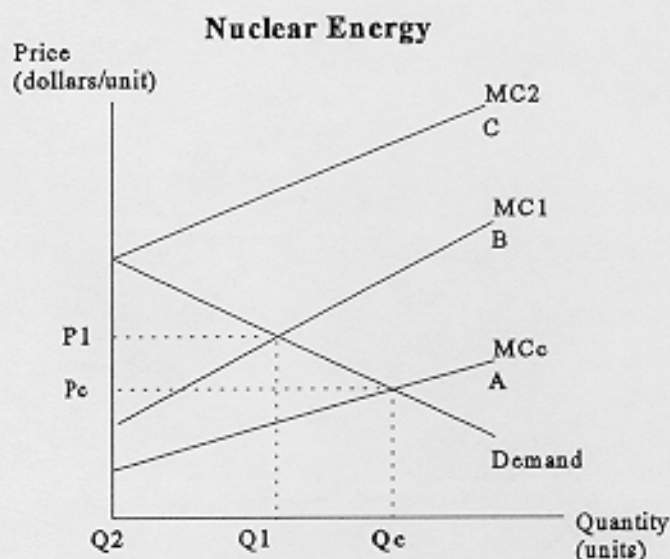


FIGURE 1

The line A represents the marginal cost curve (MCc) that nuclear energy has today, excluding the external cost of nuclear waste. This curve creates an equilibrium quantity (Q_c) that is inefficiently large as well as a price (P_c) that is inefficiently low. Line B represents the nuclear energy producers bearing all of the costs of nuclear waste disposal. This curve is the marginal cost (MC1) of nuclear energy if it remained efficient after bearing all of the cost. The new equilibrium quantity (Q_1) that results is less than the quantity (Q_c) that exists now, and the price (P_1) is higher than the current price (P_c). At the current equilibrium quantity (Q_c), the difference between the MCc and MC1 represents the external costs caused by

nuclear waste disposal. The line C represents the marginal cost curve (MC2) of the second possible outcome where the quantity that results is zero because the costs are so high that nuclear energy companies cannot bear them. The difference between MCc and MC2 at Qc is much larger than the difference between MCc and MC1 at Qc. This implies that the external costs in the second outcome are greater than those in the first outcome. Basically, if nuclear energy is ever going to be efficient, the cost of nuclear waste disposal must be borne by the producers of nuclear energy.

In order to understand the real costs of nuclear energy and its waste disposal, the problems of nuclear waste disposal need to be understood. By the year 2000 the United States will have approximately 40,000 metric tons of nuclear waste (Slovic et al, 1992). This includes only high-level wastes waiting for disposal (Slovic et al, 1992). Part of the problem is the lack of understanding of the three different types of waste. The high-level wastes have long half-lives (remain radioactive for a very long time) and must be guarded indefinitely. Low-level waste is less hazardous than high-level waste and has shorter half-lives. In between high- and low-level waste is the third type, which is transuranic waste (TRU). TRU is plutonium-contaminated material with a long half-life. (Wheelwright, 1988). The problem which arises is that all three different types incorporate different kinds of radiation in different amounts which emit at various rates for various lengths of time (Wheelwright, 1988). All three different types are hazardous and each has its special disposal needs.

The real cost of nuclear energy that is not being borne by the nuclear energy producers is nuclear waste disposal, a very costly and difficult process. The biggest concern with nuclear waste disposal is safety. A panel of the National Academy of Sciences stated: "Unlike the disposal of any other type of

waste, the hazard related to radioactive wastes is so great that no element of doubt should be allowed to exist regarding safety" (Shrader-Frechette, 1994). Low-level and TRU nuclear waste disposal don't require extreme safety precautions like high-level wastes. However, there are still problems with finding acceptable dump sites and containment of the waste. It is the high-level wastes that are the main cause of concern in the nuclear energy industry.

"No one wants the waste in their backyard, but it must go somewhere."

High-level wastes must be stored safely for 10,000 years. This presents some major problems for disposal. First, the containers in which the nuclear waste is stored only resist corrosion for 300 years. The Department of Energy even stated that "there is no doubt that the repository will leak over the course of the next 10,000 years" (Monastersky, 1988). This will lead to radioactive material being emitted into the environment. Second, during such a long time period of radiotoxicity, there could be changes in climate, precipitation, and ground water, as well as the possibility of volcanic activity (Wheelwright, 1988). Any of these changes could lead to a large release of radioactive materials. Therefore, in order to insure safety, scientists must be able to predict "precise phenomena" in the future encompassing climate, weather, mineralogy, and water composition (Wheelwright, 1988). This presents a major task considering the fact that there is only data for 30-year precipitation patterns for Yucca Mountain, which is being looked at as a high-level nuclear waste disposal facility. Making sure that all of these safety factors are met increases the cost of nuclear waste disposal and thus the cost of nuclear energy.

The real costs of nuclear energy are

complicated even more by the public's reaction to nuclear energy. Due to the fear of radioactivity which can cause health problems, such as cancer and birth defects, the general public does not want a nuclear waste disposal facility anywhere near homes. Besides health threats, a nuclear waste disposal facility would lower land values, decrease tourism, and could lead to environmental damage. In 1982 Congress authorized the Nuclear Policy Act which named Yucca Mountain, Nevada as the only site the Department of Energy could consider for a high-level waste disposal facility (Rothstein, 1992). This legislation became known as the "screw Nevada bill." In a 1990 poll of Nevadans, 80.2% would vote against the disposal facility at Yucca Mountain if it was put up for a vote (Slovic et al, 1992). This poll is a fair representation of society's feelings toward nuclear waste. No one wants the waste in their backyard, but it must go somewhere. This problem is magnified with the distrust of the government. Many people feel the government is not telling them everything. Moreover, if there was ever a problem with the waste facility, they would be the last ones to know. In the same 1990 poll of the 80.2 % who would vote against the facility at Yucca Mountain, 91.2% would strongly disagree with the statement that the Department of Energy could be trusted to disclose any problems (Slovic et al, 1992). The public's fear of nuclear waste is growing along with the distrust of the government's handling of the situation.

Currently it is the United States government funded by taxpayers that bears the real cost of nuclear waste and allows nuclear energy to remain inefficient. It has cost the United States taxpayers 3 billion dollars just to study the proposed Yucca Mountain site (Shrader-Frechette, 1994). Furthermore, the government spent another 8.7 million dollars on a public relations campaign because the people of Nevada did not want the waste disposal facility (Rothstein, 1992). The

citizens of the United States have had to pay 3 billion dollars plus for only a proposed high-level nuclear disposal facility to solve a problem that belongs to nuclear energy producers. In New Mexico, the government built a Waste Isolation Pilot Project (WIPP) for low-level and TRU waste. Besides the cost of the structure, the government paid the state of New Mexico 300 million dollars for road improvements ("Nuclear gridlock," 1992). These are just two sites that have cost a tremendous sum of money. This does not include research on other sites, radioactivity research, research on repositories, and research on alternate uses of nuclear waste; all of which is being paid for by taxpayers. For example, one possible use for plutonium waste is the Integral Fast Reactor (IFR). This device would reduce the amount of time a material remained radioactive. The government had been spending 100 million dollars a year working on this project until last year when it was eliminated from the budget (Macilwab, 1994).

Why is the government, and not the producers, dumping all of this money into nuclear waste? It is because of the energy crisis. The government feels it is their responsibility to solve this problem.

Other countries have taken different approaches to solving the problem of nuclear waste. Besides the United States, Sweden, France and Japan are also big users of nuclear energy. Sweden has stated that they will not build any new nuclear power plants and by the twenty-first century they will shut down all of those that are currently in operation (Tietenberg, 1992). It appears that Sweden has decided that nuclear energy is not a viable alternative energy source. Sweden is not alone. According to a 1992 article in *The Economist*, "most countries have quietly dropped their plans for new nuclear reactors" (Fission, 1992). However, Japan and France have taken the opposite approach. They are expanding the role of nuclear energy because

“standardized plant design and regulatory stability” have made nuclear energy cheaper than coal (Tietenberg, 1992). But this “relentless pursuit of nuclear power” has opened France up to various risks stated in a report done by the International Energy Agency (Fission, 1992). Many nuclear power plants have already sustained cracks and other damages. In France, nuclear energy is only growing because the French fund nuclear energy just like the United States. It appears that the France's growing dependency on nuclear energy is not due to efficiency, but due to government funding. Therefore, the growing consensus is that nuclear energy is not a viable alternative resource.

Personally, I do not believe that nuclear energy is a viable alternative energy source. I feel that if the government were to stop funding and subsidizing nuclear energy, it would not make a profit as shown as outcome two on the graph. First of all, there is too much cost involved. It cost 3 billion dollars just on the study at Yucca Mountain. It is important to note that this figure does not include building the facility. Plus, the material must be transported to the facility which means there is the cost of fixing the roadways en route to the facility. Once the facility is built and the roadways fixed, there are still transportation costs. There is also the cost of doing research on better methods of waste disposal. All of these costs add up to an obscene amount.

Another reason for my assessment is that the public does not have a favorable opinion of nuclear energy. The word nuclear energy brings thoughts of Chernobyl and Three Mile Island to mind. The general feeling is that no one wants anything related to nuclear energy near them, the “not in my backyard” mentality. Some people feel that incentives will encourage people to accept nuclear waste disposal sites and that the government has overlooked this measure. However, I believe that the incentives needed to persuade people

into accepting a nuclear waste disposal site would be so great that nuclear energy companies would not make a profit thus resulting in the second outcome. This is understandable with all of the safety hazards associated with nuclear energy. I believe if the government were to stop subsidizing and funding nuclear energy, we would take the same approach as Sweden.

The energy crisis is a serious problem, but the government funding of nuclear waste disposal is not the answer. This funding creates a bigger problem by producing inefficiently high amounts of nuclear waste which cannot be disposed. By eliminating the government's involvement in nuclear energy and its waste, we can evaluate if nuclear energy is truly a viable resource. Yet in the end, I predict that nuclear energy will not be able to overcome all of its costs to survive as an energy source.

REFERENCES

- Dunlap, Riley E., Kraft, Michael E., and Rosa, Eugene A., eds. *Public Reactions to Nuclear Waste*. Durham, North Carolina: Duke University Press, 1993.
- “Fission a la francaise.” *The Economist*, 25 July 1992: 19-20.
- Macilwab, Colin. “US reduces options on disposal of plutonium.” *Nature*, 11 August 1994: 404.
- Monastersky, R. “The 10,000-Year Test.” *Science News*. 27 February 1988: 139-141.
- “Nuclear gridlock.” *The Economist*, 18 January 1992: 26-27.
- Rothstein, Linda. “Nevadans dump dump ads.” *The Bulletin of the Atomic*

- Scientists*, May 1992: 3-4.
- Shrader-Frechette, Kristin. "High-level Waste, Low-level Logic." *The Bulletin of the Atomic Scientists*, November/December 1994: 40-45.
- Slovic, Paul; Layman, Mark; and Flynn, James H. *Perceived Risk, Trust, and Nuclear Waste: Lessons from Yucca Mountain*. New York: Dunlap, 1992: 64-86.
- Tietenberg, Tom. *Environmental and Natural Resource Economics*. New York: HarperCollins Publishers, 1992: 175
- Wheelwright, Jeff. "For Our Nuclear Wastes, There's a Gridlock on the Road to the Dump." *Smithsonian*, May 1988: 40-50.

Stephanie Smith ('97) wrote this paper for Environmental Economics. Originally from Pekin, Illinois, Stephanie is combining a Biology major with an Environmental Law minor during her years at Wesleyan.
