NUCLEAR ENERGY:
ADVANTAGES, DISADVANTAGES, AND POSSIBLE ALTERNATIVES

Daniel Silverman
Social Studies 11A
Mrs. Betty Kaplan
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Our planet is currently faced with a devastating problem: where are we going to find energy in the future, now that our present sources are dwindling rapidly?

Nuclear energy is one possible solution. However, many people feel that there are grave dangers inherent in the use of nuclear power. The accident at Three Mile Island has increased people's fear of nuclear energy, and a large group of anti-nuclear energy/pro-solar energy people has become more vocal than ever.

Is nuclear energy the solution to our energy crisis, or a deadly weapon in the hands of greedy businessmen? Do its benefits outweigh its risks or vice versa? This paper will show how a nuclear power plant works, present arguments in favor of and against nuclear energy, and provide brief descriptions of alternative energy sources.

A nuclear power plant uses uranium as its fuel. Uranium is a much more effective energy source than coal, oil or gas. The energy in one ounce of uranium is equivalent to the energy in 100 tons of coal.

In a nuclear power plant, uranium combines with free neutrons and breaks down into lighter elements while releasing incredible heat. This process is called nuclear fission.

There are two main types of nuclear reactors: water moderated reactors and fast breeder reactors.

First described will be the water moderated reactor. When a uranium atom absorbs a neutron and undergoes fission, in addition to producing two lighter elements, it releases two or three neutrons. These neutrons can then react with other uranium atoms, releasing more neutrons. If uncontrolled, this system could blow itself up in a very short time by creating too much heat. However, the reactor is made to prevent this situation from occuring.

A reactor is made up of a core, solid rods containing the uranium in the form of an oxide, and the control rods, which are designed to absorb the extra neutrons to prevent a "meltdown". As the rods are gradually withdrawn out of the core, fewer neutrons are absorbed and heat builds up, which boils water, which turns a turbine, which generates electricity.

In a fast-breeder reactor, the water moderator is removed, and liquid sodium is used in its place. The neutrons are able to move faster in sodium, and therefore combine faster with uranium, creating more energy. Since a breeder reactor works at a much higher temperature, and at a much faster pace, more dangers are possible, and more stringent safety regulations are enforced.

Now that we have a basic understanding of how nuclear power works, we will now discuss arguments in favor of nuclear energy.

Nuclear power is economical. Coal, oil, and gas, although much more plentiful in the world, do not contain as much potential energy as uranium, when equal amounts are compared. Therefore, though uranium may cost more to mine and more because it is rarer, the money saved through its use make it more economical than coal, oil, or gas.

Similarly, though the initial cost of a nuclear power plant is much higher than that of other energy plants, the money saved by using nuclear energy would cover the cost of its constructuon within its first six months of operation. After the initial six months of use, the nuclear plant will save money and make it much more economical than other types of energy plants for the duration of its life, usually about forty years.[1]

Another economic advantage of nuclear power is that it costs less to transport its constituents to the site of the plant. Also, it costs much more to rid coal of its impurities and contaminants than it does uranium.

At this point in time, nuclear power plants provide about 8% of the electricity used in the United States. They provide almost half of Chicago's electricity, and more than half of Connecticut's.[2] From an economic point of view, it seems we should be building more plants. However, economics are not the only consideration here. Safety and environmental factors must also be dealt with.

People's worries mainly center on the possibility of an accident as more nuclear power plants are put into use. They also think that a plant has the capability of exploding like an atom bomb.

The fact is that the uranium used in power plants differs greatly from that used in bombs, and presents no threat.

Peple are also worried about radiation leakage. The radiation from a nuclear power plant is contained in materials that prevent passage. Even if these materials fail, there are safety systems to prevent leakage-and even back-upsystems on the safety systems.

The radioactive wastes are sealed in leak proof vaults, and when transported are sealed in accident proof containers, able to withstand incredible impact.

Of course, even with all these precautions, the possibility of a death or injury still exists, but is not more probable than being hit by a falling meteorite.[3]

Let us now discuss some arguments against nuclear energy.

Nuclear power constitutes 8% of our electricity, and only 1% of our total energy supply. The United States Government assures us that this figure will grow to 15% by 1985 and to 30%-40% by 2000.[4]

In 1953, President Eisenhower announced that nuclear power would become a major energy source for the future. The Atomic Energy Commission, previously devoting its time and money solely to the exploration of nuclear weapons, was now called upon to make quick but careful advancements in the field of peaceful nuclear power.

The AEC(now Nuclear Regulatory Commission) quickly started supporting the private ownership of nuclear plants. Today, while most nuclear plants are privately owned, the government still enforces regulations.

Problems arise with the relatively simple process of nuclear energy

(discussed earlier). A major problem is the disposal of nuclear wastes. Radioactive waste produced by one average sized power plant is approximately 15,000,000 times greater that all radiation from all the radium used in the entire history of the world. Since the half-life (number of years it takes for half of the radiation to dissipate) is so great, most nuclear wastes take up to 200,000 years to dissipate--not dissimilar to forever.[5] Who are we to put the burden of making sure this radiation does not escape on some future civilization?

The fact is that radioactive wastes cannot be stored safely. It has been suggested that we bury the wastes deep underground, but there is no guarentee that the wastes will not penetrateour water supply. Shipping the wastes to far off Anarctica would not prove safe either, and would also be breaking the Antarctic Treaty of 1959. Right now, nuclear wastes are being contained in temporary storage facilities that are quickly being filled.

Another danger is the possibility of a meltdown. Despite all possible precautions, a meltdown is still possible. If the cooling system or any othersafety aspect fails, the core could overheat and burn right through the reactor, releasing incredible amounts of radiaton.

The NRC has determined that "a 'credible' large scale nuclear accident might kill 3400 people immediately, severely injuring 43,000 others, and cause $7 billion damage"[6] This estimate was in 1964, when much smaller plants were in operation than are today. The report was kept out of public access until it was recently exposed by the Union of Concerned Scientists and the Freedom of Information Act.

The NRC then asked MIT to do a study on the probability of a reactor accident, and the expected extent of damage. The result was

the Rasmussen Report, published in 1974. It estimated that there is a one-in-a-million chance of an accident, that there would be 70 deaths, 170 injuries and $2.7billion damage.[7]

The Union of Concerned Scientists ridiculed the findings, and conducted their own report. The UCS concluded that there would be 50,000immediate deaths, and a one-inone hundred thousand chance of an accident.[8]

Doctor Dixy Lee Ray, former head of the AEC likened the possibility of being killed by a nuclear accident to "being bitten by a poisonous snake while crossing a street in Washington".[9] Funny--however, that example and most other major disasters are natural occurrances. A nuclear accident would be man-made, and therefore an avoidable accident.

Is nuclear energy worth this risk? Does our government really believe it is safe? No private insurance company is willing to provide insurance for nuclear power plants, therefore the government unwillinglyprovides private industries with up to $560,000,000 insurance.[10]

Another major danger of nuclear power is the long term cancer effects resulting from radiation poisoning. If one particle of plutonium (the element used in breeder reactors) were to enter your lungs, it would produce enough radiation to cause cancer and eventual death. In nuclear testing experiments, it has been concluded that plutonium fallout would cause up to 600 deaths in 50 years from cancer. If the present growth continues, up to 130 million pounds of plutonium will be in use, and the possibility of death will increase tremendously.[11]

Another problem results with the inception of the breeder reactor. As stated earlier, the breeder reactor uses liquid sodium as opposed to

water for its heat transfer. Sodium is extremely explosive when combined with oxygen. Therefore, any sodium that leaks into the air or water would produce a devastating explosion.

Although breeder reactors produce more, and less expensive fuel, the initial cost of making the reactor is so much more than the ordinary water moderated reactor, that it costs more and loses money. Fuel only accounts for 18.2% of the total cost of the process. The other 81.8% of the cost is the construction and maintenence of the plant.[12]

One reason why nuclear power plants are so expensive is that they are privately owned. Businessmen own the plants, and are out to make profits any way they can. Builders of plants often take longer to build the plant, and owners often ignore safety and environmental protection regulations.

These corporations want to make the profit of nuclear power, and expect the government (the people) to accept the blame if anything goes wrong. This about sums up the nuclear energy policy of the United States--the profits go to big business, and "the hazards to life, the waste of billions of dollars, the rising cost of power, the impending collapse of the nuclear power program, and the ensuing economic chaos,"[13] fall in the lap of the public.

Since the dangers of nuclear energy are so grave, perhaps these and other sources of energy should be explored in greater depth...

Geothermal energy is a type of power which utilizes the earth's inner heat to produce energy.

Already proving its availability and commercial success in such places as California, Italy, Mexico, Japan, New Zealand, and Russia,[14] geothermal energy seems the perfect solution to a worldwide energy shortage. However, more advanced drilling techniques are needed, which should be devised within the next ten years.

There is presently enough coal in the United States to provide energy for the next 400 years.[15] Its availibility is no problem. But coal does produce alot of undesirable pollutants. However, through expensive chemical treatments, the number of pollutants can be reduced considerably. Also, coal can be converted into either a liquid or a gas through chemical processing.

Coal's drawback is that it is not a renewable source of energy. To solve our energy problems once and for all, we need a limitless supply of safe energy.

Fusion power adapts nuclear reactions that take place in the sun and uses them to produce large amounts of energy. Through fusion power, only one millionth of the radiation is released when compared to nuclear fission. Also up to 90% of nuclear fusion produced energy is utilized, as compared to fission's 60-70% utilization.[16] Unfortunately, fusion power is not being supported or explored by the government.

Wind power is one source of energy that cannot be exhausted. Through the use of large "windmills", turbines can be turned to create electricity.

Similarly, water power is a limitless source of energy. The use of hydroelectric power, though in use today, could be explored more deeply and be utilized more widely. One drawback of hydroelectric

power is that it can ruin the natural balance of rivers through the use of dams.

Solar energy is the perfect answer to all the problems created by nuclear energy. A renewable energy source, solar power, with government support, could at first be used with the help of other energy sources previously mentioned, and eventually, through research and development, become the major energy source of the future.

Solar cells would be owned and operated by individuals. Therefore, no major corporation would have complete control over thesystem. Solar energy can be used without major economic gain or loss to anyone, and is non-polluting. Sunlight can never be controlled by a corporation. It can be used on a small, local level, a statewide level, of even on a nationwide basis.

Solar energy would provide clean, safe energy, and social advantages to all, rather than economic advantages to a few.

ORANGE AND ROCKLAND UTILITIES, INC.

one blue hill plaza, pearl river, new york, 10965 914-352-6000

writer's direct dial number
914-627-2477

May 15, 1980

Daniel Silverman
7 South Edsall
Nanuet, NY 10954

Dear Mr. Silverman:

Enclosed are the only booklets that remain available on nuclear energy. I hope you find them helpful. Please keep in mind that all of our nuclear information was published before the Three-Mile Island incident.

If we can be of further help, please do not hesitate to contact us.

Sincerely,

Andrea Kline

Andrea Kline
Corporate Communications

The letter on the previous page is a perfect example of the absurd position in which nuclear advocates find themselves.

In early 1979, Three Mile Island nuclear power plant almost experienced a meltdown. Officials assured that there was no radiation leakage, but they lied. The public was exposed to dangerous levels of radiation.

Nuclear advocates previously had assured us that, "nothing could go wrong." Now, after the incident, they say, "Well, we'll learn from our mistakes, and nothing will ever go wrong again."

Nuclear energy is not the safe, clean energy it was said to be. The Three Mile Island incident proves this beyond a shadow of a doubt. What to do with nuclear waste is still a problem with no solution. No state wants to accept the waste because of possible radiation dangers, and some areas- such as Rockland County- have laws disallowing the transportation of nuclear waste on their roads.

Nuclear energy is not a last resort either. Alternatives such as wind, water, fusion, geothermal, coal, and solar energy are ready and available for widespread use.

What are we waiting for?

FOOTNOTES

1. The Atom and the Energy Crunch, TCI Advertising inc., 1976, p. 5.
2. Ibid., p. 7
3. Ibid., p. 9
4. Barry Commoner, The Poverty of Power, Alfred A. Knopf, New York, 1976, p. 82.
5. Ibid., p. 91.
6. Ibid., p. 94.
7. Ibid., p. 95.
8. Ibid., p. 95.
9. Ibid., p. 95.
10. Ibid., p. 97.
11. Ibid., p. 102.
12. Ibid., p. 109.
13. Ibid., p. 120.
14. John W. Gofman and Arthur R. Tamplin, Poisoned Power, Rodale Press inc. Emmaus Pa. 1971, p. 362.
15. Commoner, op. cit. p. 78
16. Gofman, Tamplin, op. cit. p. 225.

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1. Commoner, Barry, The Poverty of Power (New York: Alfred A. Knopf, 1976) pp. 78, 82-120, 153-154.

2. Gofman, John W.; Tamplin, Arthur R., Poisoned Power, (Emmous Pa.: Rodale Press inc., 1971) pp. 36-45, 225, 361-362.

3. Jungk, Robert, The New Tyranny, (New York: Fred Jordon Books, 1979) pp. 1-8.

4. The Atom and the Energy Crunch, (TCI Advertising inc., 1976)

5. Nuclear Power: What and Why, Pamphlet, no credits.