

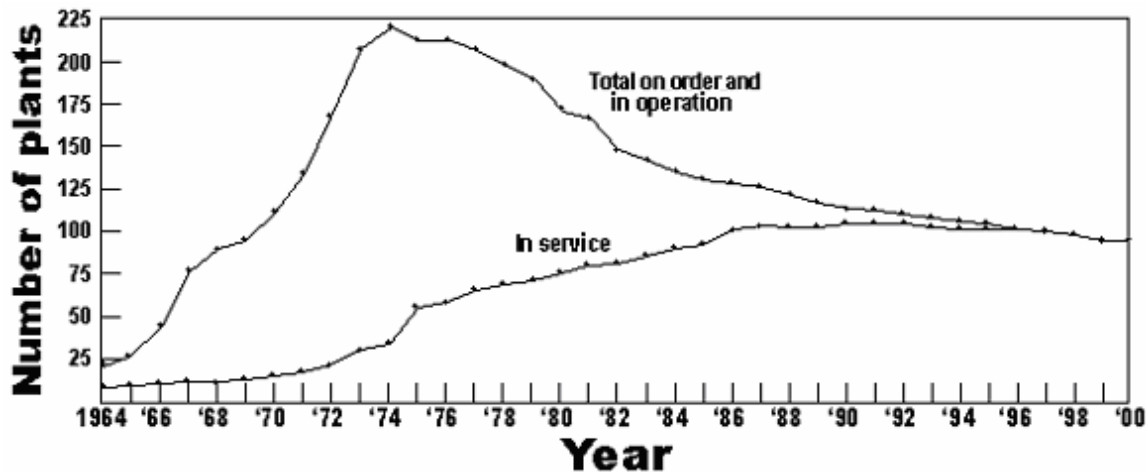
Lesson 8

Nuclear Power

No single environmental issue provokes as much controversy as the use of nuclear power. The benefits of nuclear power are numerous yet the risks are potentially great. Nuclear power is very clean and efficient yet the fear of accidents and concern over the disposal of the nuclear waste are real. It remains a highly controversial source of power around the world.

The use of nuclear power began during World War II when the atomic bomb speeded the end of the war in the Pacific. After the war, research turned to the use of nuclear energy to produce electricity. Beginning in the 1960s, nuclear power plants began to be built throughout the world. The promise of nuclear power was great. In 1975, fifty-three nuclear power plants in the United States met nine percent of the country's demand for electricity. It was thought that there would be several hundred plants by the 1990s with as many as a thousand by the year 2000. But this never happened. Public concern over safety issues and numerous protests made the building of new plants very controversial.

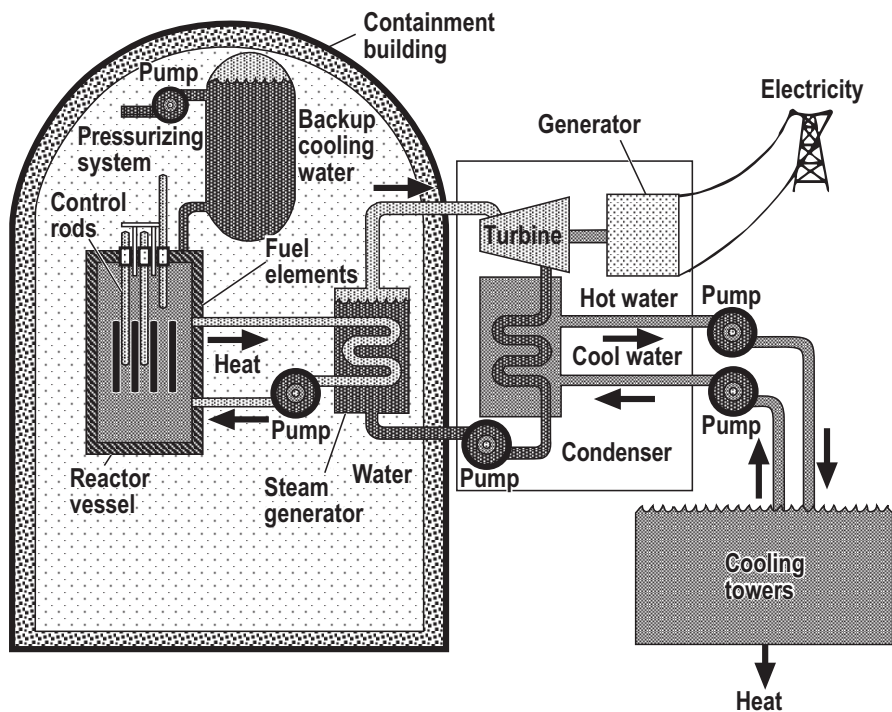
Utility companies cancelled orders and new orders virtually stopped. Construction stopped on plants that were already being built. By the year 2000, one hundred and four nuclear power plants in the United States were in operation producing 20 percent of the country's electrical needs. There are presently no plans to build new plants in this country. Nuclear power plants have a relatively short life span (fifteen to thirty years); therefore, the number of operating plants is decreasing.



Elsewhere in the world, nuclear power is still an option that some countries are continuing to pursue. In the year 2000, there were 433 operating nuclear power plants with an additional 37 under construction. These 433 plants produce 17 percent of the world's electric needs. France leads the world in its dependence on nuclear power with 75 percent of its electricity generated in atomic reactors with plans to increase that number to 80 percent.

A nuclear power plant uses uranium as a fuel. Uranium is a metal found in the earth's surface. It is found, like all the metals, in deposits all around the world. It looks something like lead and is heavy like lead. Uranium is mildly radioactive and possesses a special property where if it is bombarded with neutrons, the uranium nucleus splits in two, at the same time releasing a large amount of energy in the form of heat. This is called **fission**. A very small amount of material can give you vast amounts of energy which can then be converted into electricity.

The chemistry of a nuclear bomb and that of a nuclear reactor is similar. In both, a chain reaction occurs. Basically, one atom of uranium is split, creating particles that split other atoms. At each step, more particles are given off which split more atoms, creating more particles and so forth. At each splitting, energy is given off. In nuclear power plants, great care is taken to control the reaction. In an atomic bomb, the chain reaction is allowed to occur uncontrolled and the energy is released all at once. History shows how destructive this power can be.



Advocates for the use of nuclear power, instead of coal, point to the benefits. Coal produces much air pollution. Nuclear power creates almost none. The amount of fuel needed for a nuclear power plant is very small compared to a coal plant.

Environmental damage from coal mining is much more severe than from mining uranium. Burning coal produces huge amounts of solid waste; nuclear reactors produce very little. So why do so many fear this technology? There are two major problems with the use of nuclear power—dealing with the radioactive waste, and the risk of accidents.

Radioactive waste is known to cause cancer. It can be harmful in very small amounts and it is unknown if there is a safe level of exposure. Radioactive waste remains dangerous for many years. How long is determined by something called **half-life**. A half-life is the number of years needed for a sample of a radioactive waste to lose half its potency or power. This number can range from thousands to millions of years. Presently, nuclear waste is being stored primarily on the site of each power plant. This solution is only for the short term; a long term solution to the problem needs to be found. The United States government plans on developing a permanent storage facility in Utah's Yucca Mountain as a long-term disposal site for this country's nuclear waste.

Nuclear power plant accidents have been few in the past. Still, the ones that have occurred were extensively covered in the news, creating worldwide concern. The worst accident in the United States occurred at Three Mile Island near Harrisburg, Pennsylvania in 1979. This accident was a partial meltdown. A meltdown occurs when extreme heat in the

reactor becomes uncontrollable, causing the reactor to melt. When this superheated material hits the water used for cooling, an explosion occurs, releasing tremendous amounts of radioactive gases into the atmosphere. At Three Mile Island, some radioactive gas was given off but no injuries or deaths resulted. The worst accident in history occurred at Chernobyl in the former Soviet Union. This accident resulted in an explosion that killed 31 people. It is estimated that future deaths from this incident due to radiation exposure may range from 140,000-475,000 people. These two accidents shook the public trust in the nuclear energy industry and were major contributors to its decline.

Analysis

1. Summarize the benefits of nuclear power.

2. What are the risks of nuclear power?

3. Trace the history of nuclear power in the United States. What trend do you see?

4. What is the status of nuclear power around the world?

5. Summarize how a nuclear power plant works.

6. What happened at Three Mile Island and Chernobyl?
