Advantages of Nuclear Power

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Artemus Ward, Mark Twain's predecessor, once said: "It ain't the things we don't know that gets us into trouble. It's the things we know that just ain't so." Regulators know that exposure to ionizing radiation, even in very low doses, is harmful. They say that no amount of radiation can be proclaimed safe. There is no threshold below which the deleterious effects of radiation cease to appear. This "knowledge" has, indeed, caused us a lot of trouble, and it turns out not to be true. The actual truth is this: Not only are low to moderate doses of ionizing radiation not harmful, low doses of radiation are good for you. It stimulates the immune system and checks oxidation of DNA through a process known as "radiation hormesis"—and thereby *prevents* cancer. And irradiated mothers bear children that have a reduced incidence of congenital deformities. (See my article Afraid of Radiation? Low Doses are Good for You.)

Owing to the public's fear of radiation, abetted by the nuclear protection industry and the media, nuclear power in the United States is at a standstill, just when we most need it. Construction on all nuclear power plants ordered after 1974 has stopped, and no orders have been placed for any since 1978. In the last 15 years, 8 nuclear power plants in the U.S. have been shut down because of escalating regulatory costs and public fears about radiation (103 remain).

The U.S. uses fossil fuels, mainly coal and natural gas, to produce 70 percent of its electricity. Nuclear power generates 19 percent and hydroelectric dams the other 11 percent. (Energy obtained directly from the sun, gathered by mirrors or photovoltaic cells, and from wind turbines generates less than one-tenth of one percent of our electricity.) Production of electricity consumes 36 percent of the energy we use.

Oil is now used primarily for transportation—to run our automobiles, trucks, airplanes, ships, and most buses and railroad trains. Overall, the U.S. obtains 85 percent of its energy from fossil fuels—about half from oil and the other half equally from coal and natural gas. (Before drilling for oil began in the 1800s, humans had just two main sources of energy, other than their own manual labor: wood and animals. Today, rather than ride horses, teenagers compare the horsepower of their automobiles.)

Compared to coal and hydroelectric dams, nuclear power is the safest and cleanest way, from an environmental standpoint, to produce electricity. And the fuel it uses, uranium, is more abundant than fossil fuels (or rivers left to be dammed). In contrast to the U.S., other countries do recognize the advantages of nuclear power. France uses nuclear power to generate 77 percent of its electricity, and 35 nuclear power plants are currently under construction around the world, 24 of them in Asia.

With 442 nuclear power plants operating in 32 countries for a cumulative 10,000 reactor-years of commercial operation, Chernobyl, in the former Soviet Union, is the only accident in the history of nuclear power where any radiation-related fatalities have occurred. In that accident (in 1986) radioactivity from part of the reactor's overheated core escaped into the atmosphere. Acute radiation sickness affected 134 employees and 28 died. An estimated 70 extra cases of thyroid cancer occurred in children as a result of the accident, which could have been prevented by timely ingestion of potassium iodide. Otherwise, no increase in the incidence of other cancers occurred (despite dire predictions, based on the linear no-threshold hypothesis, that 110,000 new cancers would occur due to radioactive fallout from the accident). Chernobyl's real victims were 200,000 pregnant women in Europe who, caught up in a wave of radiophobic hysteria, feared that their fetuses would be damaged by radiation from the fallout and had their pregnancies terminated. Low dose radiation does not cause genetic defects, and fetuses exposed to radiation from Chernobyl that were not aborted developed normally and did not have any increased incidence of congenital abnormalities or genetic defects.

Chernobyl is unique. That kind of accident will not happen in any other nuclear power plants because all the reactors currently in operation around the world are placed inside a containment building (Chernobyl was not). The reactor core meltdown at Three Mile Island in 1979, which happened when its core cooling system failed, also produced a lot of radiation; but the containment building the reactor was housed in kept it from being released into the atmosphere, and there were no injuries or deaths.

All the nuclear power plants in the U.S. are second-generation reactors, based on designs derived from those made for naval use. Third generation reactors, with an output of 600 MW, are simpler, smaller, more rugged, and reduce substantially the possibility of a core meltdown accident, from a likelihood of 1 in 20,000 to 1 in 800,000 per reactor year. (Third generation reactors have, for example, 80 percent fewer control cables and 60 percent less piping.) They are standardized to expedite licensing and reduce construction time. Fourth generation fusion reactors are being developed that should be in operation fairly soon.

On the Columbia River System, in my part of the world, 75 people died building the Grand Coulee Dam. Failure of the Teton Dam on a tributary of the Snake River near Idaho Falls (in 1976) killed 14 people, obliterated one town (Wilford), severely damaged several others, and caused $3 billion (2002 dollars) in property damage. The energy released when this dam ruptured was the equivalent of ten (20 kiloton) atom bombs, and it caused the greatest flood in North America since the last ice age. (Fortunately, the dam failed during the daytime, which saved thousands of lives because workers were there to warn the populace downstream to evacuate, before phone lines went down.) The St. Francis Dam in Santa Paula, California collapsed (in 1928) and killed 450 people. The Machu Dam in India killed 2,500 people when it ruptured in 1979.

Compared to nuclear power, coal is a much less safe source of energy. In addition to the pollutants and carcinogens coal delivers into the atmosphere when burned, 100 coal miners are killed each year in the U.S. in coal mine accidents and another 100 die transporting it. Per amount of electricity produced, hydropower causes 110 fold, coal, 45 fold, and natural gas, 10 fold more deaths than nuclear power. As Petr Beckmann, founding editor of *Access to Energy*, shows in his book *The Health Hazards of Not Going Nuclear*, nuclear power is the safest source of energy in *all* aspects, not excluding terrorism and sabotage, major accidents, and waste disposal.

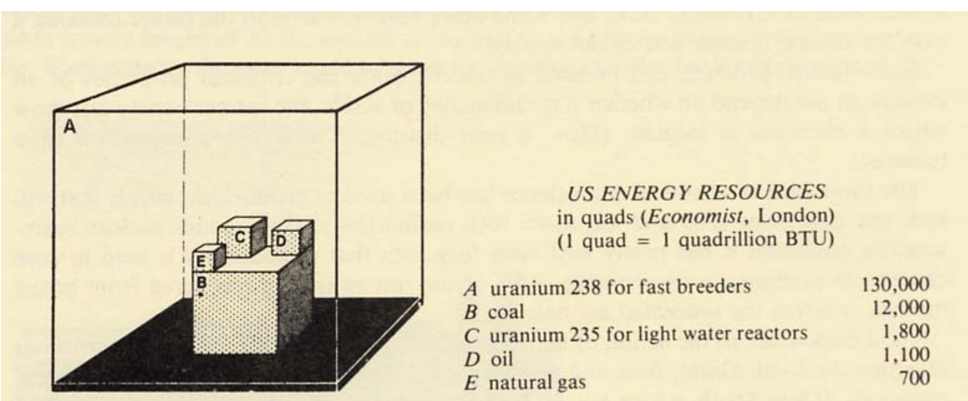
From an environmental standpoint, nuclear power is far superior to coal or hydropower. In the U.S., coal is strip-mined (the way we get 60 percent of it) at a rate of more than 65,000 acres per year, with over a million acres awaiting reclamation. Of the 8 million acres that overlie underground mines (to obtain the other 40 percent), one-fourth of that acreage has subsided. When burned, the carbon in coal combines with oxygen to form carbon dioxide (CO_2) and carbon monoxide (CO). A large coal-burning plant that produces as much electricity as a nuclear power plant burns 3 million tons of coal annually, which generates 11 million tons of CO_2 (700 lbs. per second). Coal contains sulfur, 0.5 to 3 percent by weight, which combines with oxygen to form sulfur dioxide, the principal cause of acid rain; and the nitrogen in it produces nitrous oxide, a major pollutant (a 1,000 megawatt coal plant produces as much nitrous oxide as 200,000 automobiles). It contains health-damaging heavy metals like lead, mercury, arsenic, cadmium, and beryllium. Coal also has uranium in it in a concentration of 1 to 2 parts per million. As a result, a coal-fired plant releases up to 50 times more radioactivity than a nuclear plant, where the radiation emitted by uranium and its byproducts is contained. (The EPA ignores this fact.)

Hydropower is even worse. Hydroelectric dams generate 85 percent of the electricity produced in my state (Washington). The dams in the Columbia River Basin have had a devastating impact on its ecosystem. It began with the New Deal, in 1932, when the Army Corps of Engineers submitted a study of the river to President Roosevelt identifying ten promising locations for dams. Beginning with the Bonneville Dam, built by the Corps of Engineers, and the Grand Coulee Dam, built by the Bureau of Reclamation, over the next 40 years these two federal agencies built 30 major dams on the Columbia and Snake River system. Its largest, the Grand Coulee Dam, blocks salmon access to more than 1,000 miles of productive river. Called the "cesspool of the New Deal" (by a New York newspaper), its 125 square mile reservoir inundated 12 towns with 1,200 buildings.

The hydroelectric dams in the Columbia River Basin (along with hatcheries that the Bureau established to mitigate their effects on fish) have been instrumental in reducing the number of wild salmon that come back up the Columbia River each year to spawn, from 10 to 16 million to less than 200,000 now, a 98 percent decline. Eliminating the nutrients (obtained eating crustaceans and plant life in the ocean) that salmon provide for the Basin has had a major impact on its ecosystem. Salmon gain 90 percent of their body weight at sea and carry the nutrients obtained there back to their home stream. Grizzly bears, for example, obtain up to 90 percent of the nitrogen in their bones and hair from the salmon they eat. The environmental impact of the decline of salmon is reflected in these Washington Department of Fish and Wildlife estimates: the Basin's population of fur-bearing mammals has declined from 13,000 to 500; game birds dependent on this landscape, from 120,000 to 2,000; and winter songbirds, from 95,000 to 3,000. Twelve second-generation nuclear power plants would produce as much electricity as all the hydroelectric dams that have been built in this Basin, at a negligible environmental cost.

Nuclear energy (that uranium 235 and uranium 238-derived plutonium produce) emits no harmful gases or toxic metals into the environment. And, unlike hydroelectric dams, it does not alter a region's ecosystem. Furthermore, despite what activists and the media say, the wastes nuclear power create are far less of a problem than those produced by coal, or the silt that builds up behind dams. One pound of uranium produces 20,000 times more energy than one pound of coal. A nuclear power plant generates (high-level) radioactive wastes the size of one aspirin tablet per person per year (a plant's yearly wastes fit comfortably under a dining room table). Coal-fired plants generate 320 lbs of ash and other poisons per person per year, of which 10 percent is spewed into the atmosphere. Disposal personnel encapsulate nuclear waste in (fireproof, water-proof, and earthquake-proof) boron-silicate glass or ceramic and then bury these now effectively non-radioactive artificial rocks. In the U.S., these "rocks" will (in 2010) be buried deep in extremely arid ground in a remote part of Nevada, in a repository at Yucca Mountain (where nuclear weapons tests were once conducted). The chance that this encapsulated waste will ever harm anyone is virtually zero (especially given that the linear no-threshold hypothesis now disproved). Waste disposal is not a disadvantage of nuclear power; it is one of its advantages.

Yet another advantage of nuclear power is the relative abundance of its fuel, as this illustration, put together by Petr Beckmann, shows. Uranium is the heaviest of all naturally occurring elements and is present in most of the earth's crust. There is enough uranium 235 (box C), the fuel for current-day U.S. nuclear reactors, to keep them operating through most of this century. But uranium 238 (99 percent of natural uranium), fuels breeder reactors. Breeder reactors turn uranium-238 into plutonium. As Bernard Cohen points out in his book, *The Nuclear Energy Option* (in Chapter 13, which is available online), the supply of uranium 238 on the planet to run breeder reactors will last thousands of years.



Oil is dwindling fast in the U.S. In 1950 America produced one-half of the world's oil and consumed 6 million barrels per day (MBPD), which was more oil than all the rest of the world consumed. Today the U.S. produces 4 percent of the world's oil and consumes 20 MBPD, and the rest of the world consumes close to 60 MBPD. (China, with its 1.2 billion people, leads the race in growing oil consumption, and it has to import an increasing percentage of the oil that it consumes. India, with one billion people, is close behind.)

Sixty percent of the known oil in the world lies within this "golden triangle" in the Middle East. Oil wells there pump 10,000 barrels per day, compared with wells in the U.S that pump 300 barrels per day. U.S. oil reserves have now dropped to the point that if we were not able to import any oil, at the current rate of consumption, we would exhaust our 22 billion barrel reserve and run out of oil in three years.

The "War on Terror," as the Bush Administration has chosen to prosecute it, is designed to further American energy interests. It's "all about oil." In addition to U.S. bases in Kuwait and Saudi Arabia, and the 14 new ones that are planned for Iraq, the U.S. has also established military bases, known as "power projection hubs," in Bahrain, Qatar, United Arab Emirates, and Oman. One base in Qatar, one of several in that country, is particularly valued by the Air Force because it has a three-mile long runway.

Iraq has 11 percent of the world's oil, five times as much as the U.S. now has. The only other country with more is Saudi Arabia. This map, prepared by the National Energy Policy Development Group, chaired by Vice-President Cheney (obtained by Judicial Watch through the Freedom of Information Act) shows the location and extent of Iraq's known oilfields and divides the western part of the country into nine exploration blocks.

Central Asia is another important source of oil and natural gas. (America's natural gas wells now produce only one-third the amount of gas they did 30 years ago.) The problem is how to get it out. One of the Bush Administration's goals in occupying Afghanistan is to build a pipeline through that country to the Arabian Sea that avoids going through Russia or Iran. With the Taliban running Afghanistan there was no hope that this pipeline could be built.

There is another way to get oil for our automobiles and airplanes, which would eliminate the need for the United States to import any Middle Eastern or Central Asian oil. American entrepreneurs are marketing a new technology called a "thermal conversion process" that can make oil out of various agricultural, industrial, and municipal wastes; and nuclear power is the best source of electricity to run it. The process employs a technique known as thermal depolymerization, which in essence mimics the geothermal process that created our fossil fuels, notably oil. Wastes subjected to temperatures of 500 degrees F and pressures of 600 pounds per square inch, under controlled conditions, will produce light oil that is half diesel and half gasoline.

You can put most anything in it—sewage sludge, plastic bottles, old tires, turkey offal, wet bandages and needles. If a 175 lb. person accidentally got caught in the process, it would turn him into 38 pounds of oil, 7 pounds of purified minerals, 7 pounds of methane gas, and 123 pounds of water. Putting all the country's agricultural wastes through this process would produce 4 billion barrels of oil, the amount we currently import from OPEC each year.

What about solar power and windmills as an alternative source of energy? California is the leader in developing solar power. Its Solar Two Plant in the Mojave Desert has a peak output of 10 megawatts. In order to produce as much energy as a 1,000 megawatt nuclear reactor, its mirrors would have to occupy 127 square miles of land. The Solar Electric Generating System in Kramer Junction, CA has a higher output—100 megawatts. This system currently generates 90 percent of the world's direct solar electricity. (It has rows of mirror-like shiny surfaces that focus sunlight onto tubes filled with therminol fluid running along the top of the array, which turns water into steam to power the turbines.) Its mirrors have to be washed every five to ten days to maintain a reasonable (70 percent) optical efficiency. It requires 33 square miles of mirrors for this system to produce as much electricity as one nuclear power plants. Also, solar plants require substantial government subsidies and tax credits to make the electricity they produce economically feasible.

The Nine Canyon Wind Project in my state completed its Phase II expansion last year, adding 12 new wind turbines to the previously existing 37. With the wind blowing hard, they have a peak output of 64 megawatts. Based on the average wind speed there it would take 50,000 wind turbines of this size, in a 300 square mile area, to generate the same amount of electricity one nuclear power plant produces. (If they were made to the height of a 20-story building, it would take only 1,000 windmills to produce that amount of power.)

Windmills kill a lot of birds. They act as bait and executioner for birds because rodent populations multiply rapidly at their base, and the birds get killed trying to get at them. The windmills on Altamont Pass east of San Francisco, for example, kill eight times as many bald eagles each year as those that died in the one-time Valdez oil spill in Alaska. This is also a problem with solar energy. Bird deaths per megawatt of electricity generated by solar plants are higher than at Altamont Pass, a result of their flying into its mirror-like surfaces. Despite the enthusiasm politicians and the media exhibit for solar and wind power, these sources of energy, compared with nuclear power, produce tiny amounts electricity; and they harm the environment. They cannot replace fossil fuels, or nuclear power.

The many billions of dollars our government is spending occupying Iraq and Afghanistan, to ensure a continued supply of fossil fuels, would be much better spent building nuclear reactors.

Our country needs to bring the troops home and start building third (and fourth) generation nuclear power plants, like China and other Asian nations are doing. The War on Terror will not be won, with our adversary employing fourth-generation-warfare suicide attacks on civilians in one's homeland, until our country pulls its stick out of the hornet's nest. The only way Muslim terrorists are going to leave us, and our soon-to-be former allies like Spain alone is if we pull all of our troops out of the Middle East, and leave them alone.

This is perhaps the greatest advantage of nuclear power, coupled with new technologies like thermal depolymerization. It will better enable our country to follow the advice its first President gave us in his Farewell Address—to conduct dealings with other nations in the marketplace, not on the battlefield. Building nuclear power plants can help end the War on Terror, in addition to keeping our lights and computers on.