

## **I oversaw the U.S. nuclear power industry. Now I think it should be banned**

Gregory Jaczko

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Nuclear power was supposed to save the planet. The plants that used this technology could produce enormous amounts of electricity without the pollution caused by burning coal, oil or natural gas, which would help slow the catastrophic changes humans have forced on the Earth's climate. As a physicist who studied esoteric properties of subatomic particles, I admired the science and the technological innovation behind the industry. And by the time I started working on nuclear issues on Capitol Hill in 1999 as an aide to Democratic lawmakers, the risks from human-caused global warming seemed to outweigh the dangers of nuclear power, which hadn't had an accident since Chernobyl, 13 years earlier.

By 2005, my views had begun to shift.

I'd spent almost four years working on nuclear policy and witnessed the influence of the industry on the political process. Now I was serving on the Nuclear Regulatory Commission, where I saw that nuclear power was more complicated than I knew; it was a powerful business as well as an impressive feat of science. In 2009, President Barack Obama named me the agency's chairman.

Two years into my term, an earthquake and tsunami destroyed four nuclear reactors in Japan. I spent months reassuring the American public that nuclear energy, and the U.S. nuclear industry in particular, was safe. But by then, I was starting to doubt those claims myself.

Before the accident, it was easier to accept the industry's potential risks, because nuclear power plants had kept many coal and gas plants from spewing air pollutants and greenhouse gases into the air. Afterward, the falling cost of renewable power changed the calculus. Despite working in the industry for more than a decade, I now believe that nuclear power's benefits are no longer enough to risk the welfare of people living near these plants. I became so convinced years after departing office that I've now made alternative-energy development my new career, leaving nuclear power behind. The current and potential costs - personal and economic - are just too high.

Nuclear plants generate power through fission, the separation of one large atom into two or more smaller ones. This atomic engine yields none of the air pollutants produced by the combustion of carbon-based fuels. Over the decades since its inception in the 1950s, nuclear power has prevented hundreds of fossil-fuel plants from being built, meaning fewer people have suffered or died from diseases caused by their emissions.

But fission reactors have a dark side, too: If the energy they produce is not closely controlled, they can fail in catastrophic ways that kill people and render large tracts of land uninhabitable. Nuclear power is also the path to nuclear weapons, themselves an existential threat.

As the certainty of climate change grew clearer, nuclear power presented a dilemma for environmentalists: Was the risk of accidents or further spread of nuclear weapons greater than the hazard of climate change? In the late 2000s, the arguments in support of nuclear power were gaining traction with Congress, academia and even some environmentalists, as the Chernobyl accident faded into the past and the effects of climate change became harder to ignore. No new plants had been

proposed in decades, because of the industry's dismal record of construction oversight and cost controls, but now utilities were beginning to pitch new reactors - as many as 30 around the country.

But the Fukushima Daiichi crisis reversed that momentum. A massive release of radiation from that plant, as its four reactors failed, lasted for months. The world watched as hydrogen explosions sent huge chunks of concrete into the air - a reminder that radiation was streaming, unseen, from the reactor core. More than 100,000 people were evacuated from their homes and their communities.

Most have not returned, because only select areas have been remediated, making the surrounding region seem like a giant chessboard with hazardous areas next to safer ones. The crisis hobbled the Japanese economy for years. The government estimated that the accident would cost at least \$180 billion. Independent estimates suggest that the cost could be three times more.

There were obvious ramifications for the entire industry: Could what happened in Japan happen elsewhere? This accident consumed my work at the NRC for the next six months. I assured the public of the safety of U.S. plants, because I did not have enough information or a legal basis at that point to say otherwise. But I also promised to thoroughly review the safety measures we had in place and to swiftly implement any necessary reforms the agency identified. Agency staffers soon produced a reasonable set of plant improvements that would reduce the chance of a similar accident here. The staff found weaknesses in the programs for dealing with fires, earthquakes and flooding - the kinds of natural disasters that could trigger a catastrophe like Fukushima.

Yet after the disaster, my fellow commissioners, as well as many in Congress and the nuclear industry, fretted that the proposed new U.S. reactors might never be built, because Fukushima would focus too much attention on the potential downsides. Westinghouse and the new plant owners worried that acknowledging the need for reforms would raise even more concern about the safety of reactors. The industry wanted the NRC to say that everything was fine and nothing needed to change. So my colleagues on the commission and supporters of the industry pushed to license the first of these projects without delay and stonewalled implementation of the safety reforms. My colleagues objected to making the staff report public. I ultimately prevailed, but then the lobbying intensified: The industry almost immediately started pushing back on the staff report. They lobbied the commission and enlisted allies in Congress to disapprove, water-down or defer many of the recommendations.

Within a year of the accident at Fukushima - and over my objections - the NRC implemented just a few of the modest safety reforms that the agency's employees had proposed, and then approved the first four new reactor licenses in decades, in Georgia and in South Carolina.

But there was a problem. After Fukushima, people all over the world demanded a different approach to nuclear safety. Germany closed several older plants and required the rest to shut down by 2022. Japan closed most of its plants. Last year, even France, which gets about 80 percent of its electricity from nuclear power, proposed reducing that figure to 50 percent by 2035, because safety could not be guaranteed. Trying to make accidents unlikely wasn't enough.

And here in the United States, those four new reactors - the vanguard of the "nuclear renaissance" - still haven't opened. The South Carolina companies building two of the reactors canceled the project in 2017, after spending \$9 billion of their customers' money without producing a single electron of power. The construction company behind the utilities, Westinghouse, went bankrupt, almost destroying its parent company, the global conglomerate Toshiba. The other two reactors licensed while I chaired the NRC are still under construction in Georgia and years behind schedule. Their cost has ballooned from \$14 billion to \$28 billion and continues to grow.

History shows that the expense involved in nuclear power will never change. Past construction in the United States exhibited similar cost increases throughout the design, engineering and construction process. The technology and the safety needs are just too complex and demanding to translate into a facility that is simple to design and build. No matter your views on nuclear power in principle, no one

can afford to pay this much for two electricity plants. New nuclear is simply off the table in the United States.

After I left the NRC in 2012, I argued that we needed new ways to make accidents impossible. When a reactor incident occurs, the plant should not release any harmful radiation outside the plant itself. I was not yet antinuclear, just pro-public-safety. But nuclear proponents still see this as "antinuclear." They knew, as I did, that most plants operating today do not meet the "no off-site release" test. I think a reasonable standard for any source of electricity should be that it doesn't contaminate your community for decades.

Coal and natural gas do not create this kind of acute accident hazard, though they do present a different kind of danger. Large dams for hydroelectric power could require evacuation of nearby communities if they failed - but without the lasting contamination effect of radiation. And solar, wind and geothermal energy pose no safety threat at all.

For years, my concerns about nuclear energy's cost and safety were always tempered by a growing fear of climate catastrophe. But Fukushima provided a good test of just how important nuclear power was to slowing climate change: In the months after the accident, all nuclear reactors in Japan were shuttered indefinitely, eliminating production of almost all of the country's carbon-free electricity and about 30 percent of its total electricity production. Naturally, carbon emissions rose, and future emissions-reduction targets were slashed.

Would shutting down plants all over the world lead to similar results? Eight years after Fukushima, that question has been answered. Fewer than 10 of Japan's 50 reactors have resumed operations, yet the country's carbon emissions have dropped below their levels before the accident. How? Japan has made significant gains in energy efficiency and solar power. It turns out that relying on nuclear energy is actually a bad strategy for combating climate change: One accident wiped out Japan's carbon gains. Only a turn to renewables and conservation brought the country back on target.

What about the United States? Nuclear accounts for about 19 percent of U.S. electricity production and most of our carbon-free electricity. Could reactors be phased out here without increasing carbon emissions? If it were completely up to the free market, the answer would be yes, because nuclear is more expensive than almost any other source of electricity today. Renewables such as solar, wind and hydroelectric power generate electricity for less than the nuclear plants under construction in Georgia, and in most places, they produce cheaper electricity than existing nuclear plants that have paid off all their construction costs.

In 2016, observing these trends, I launched a company devoted to building offshore wind turbines. My journey, from admiring nuclear power to fearing it, was complete: This tech is no longer a viable strategy for dealing with climate change, nor is it a competitive source of power. It is hazardous, expensive and unreliable, and abandoning it wouldn't bring on climate doom.

The real choice now is between saving the planet or saving the dying nuclear industry. I vote for the planet.

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Jaczko served on the Nuclear Regulatory Commission from 2005 to 2009, and as its chairman from 2009 to 2012. The author of "Confessions of a Rogue Nuclear Regulator," he is the founder of Wind Energy LLC and teaches at Georgetown University and Princeton University.

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