

# Bill Gates' Bad Bet on Plutonium-fueled Reactors

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*One of Bill Gates' causes is to replace power plants fueled by coal and natural gas with climate-friendly alternatives. That has led the billionaire philanthropist and Microsoft co-founder to embrace nuclear power, and building nuclear power plants to combat climate change is a prospect worth discussing. But Gates has been persuaded to back a costly reactor design fueled by nuclear-weapon-usable plutonium and shown, through decades of experience, to be expensive, quick to break down, and difficult to repair.*

In fact, Gates and his company, Terrapower, are promoting a reactor type that the US and most other countries abandoned four decades ago because of concerns about both nuclear weapons proliferation and cost.

The approximately 400 power reactors that provide about 10 percent of the world's electric power today are almost all water-cooled and fueled by low-enriched uranium, which is not weapon usable. Half a century ago, however, nuclear engineers were convinced—wrongly, it turned out—that the global resource of low-cost uranium would not be sufficient to support such reactors beyond the year 2000.

Work therefore began on liquid-sodium-cooled “breeder” reactors that would be fueled by plutonium, which, when it undergoes a fission chain reaction, produces neutrons that can transmute the abundant but non-chain-reacting isotope of natural uranium, u-238, into more plutonium than the reactor consumes.

But mining companies and governments found a lot more low-cost uranium than originally projected. The Nuclear Energy Agency recently [concluded](#) that the world has uranium reserves more than adequate to support water-cooled reactors for another century.

And while technologically elegant, sodium-cooled reactors proved unable to compete economically with water-cooled reactors, on several levels. Admiral Rickover, who developed the US Navy's water-cooled propulsion reactors from which today's power reactors descend, tried sodium-cooled reactors in the 1950s. His [conclusion](#) was that they are “expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair.” That captures the experience of all efforts to commercialize breeder reactors. The United States, Germany, the United Kingdom, France, and Japan all abandoned their breeder-reactor efforts after

spending the equivalent of \$10 billion or more each on the effort.

Today, despite about [\\$100 billion](#) spent on efforts to commercialize them, only two sodium-cooled breeder reactor prototypes are operating—both in Russia. India is building one, and China is building two with Russian help. But it is not clear India and China are looking only to generate electricity with their breeders; they may also be motivated in part by the fact that breeder reactors produce copious amounts of the weapon-grade plutonium desired by their militaries to expand their nuclear-weapon stockpiles.

The proliferation risks of breeder-reactor programs were dramatically demonstrated in 1974, when India carried out its first explosive test of a nuclear-weapon design with plutonium that had been produced with US Atoms for Peace Program assistance for India's ostensibly peaceful breeder reactor program. The United States, thus alerted, was able to stop four more countries, governed at the time by military juntas (Brazil, Pakistan, South Korea, and Taiwan), from going down the same track—although Pakistan found another route to the bomb via uranium enrichment.

It was India's 1974 nuclear test that got me involved with this issue as an advisor to the Carter administration. I have been involved ever since, contributing to the plutonium policy debates in the United States, Japan, South Korea and other countries.

In 1977, after a policy review, the Carter administration [concluded](#) that plutonium breeder reactors would not be economic for the foreseeable future and called for termination of the US development program. After the estimated cost of the Energy Department's proposed demonstration breeder reactor increased five-fold, [Congress finally agreed](#) in 1983.

But the dream of plutonium breeder reactors lived on in the Energy Department's Idaho National Laboratory, and, during the Trump administration, the department agreed to back the construction at INL of a plutonium-fueled, sodium-cooled reactor, deceptively called the "Versatile Test Reactor." The VTR is a bigger version of INL's Experimental Breeder Reactor II, which I helped shut down in 1994 because the reactor no longer had a mission, when I worked in the Clinton administration's White House.

The consortium that is to build the Versatile Test Reactor, at an estimated cost of [up to \\$5.6 billion](#), includes Bill Gates' Terrapower.

Gates is obviously not in it for the money. But his reputation for seriousness may have helped recruit Democratic Senators Cory Booker, Dick Durbin, and Sheldon Whitehouse to join the two Republican senators from Idaho in a bipartisan coalition to co-sponsor the [Nuclear Energy Innovations Capabilities Act of 2017](#), which called for the VTR.

I wonder if any of those five Senators knows that the VTR is to be fueled annually by enough plutonium for [more than 50](#) Nagasaki bombs. Or that it is a failed technology. Or that the Idaho National Laboratory is collaborating on plutonium separation technology with the Korea Atomic Energy Research Institute at a time when about [half of South Korea's population](#) wants nuclear weapons to deter North Korea.

Fortunately, it is not too late for the Biden administration and Congress to avoid repeating the mistakes of the past and to zero out the Versatile Test Reactor in the Department of Energy's next budget appropriations cycle. The money could be spent more effectively on upgrading the safety of our existing reactor fleet and on other climate-friendly energy

technologies.

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