

Max Schulz respond to the article by Makhijani and Smith, "Nuclear is not the Way."

It will serve nobody's interest to offer a line-by-line rebuttal of Arjun Makhijani's and Brice Smith's essay. The space allotted is too short. In any event, I have offered my own argument, which I am happy to let stand on its own. Still, there are a few broad points I want to address about their piece, which, while eloquently argued, I believe ultimately falls short.

Messrs. Makhijani and Smith hang their criticism of nuclear power on three things: "cost, proliferation, and accident risks." They cite these as the principal things to deal a blow to the nuclear industry after the 1979 Three Mile Island accident, and they go on to wonder—ominously—"How serious will these risks become if nuclear power has a second life?"

Let's start with the question of cost. First, it is fair to say the issue of cost is not really a "risk," at least not like the very real ones associated either with proliferation or an accident at a nuclear plant. As to what the precise costs are for generating electricity from nuclear power, as opposed to other sources such as wind (cited by the authors as a "reasonable alternative . . . for the same cost"), observant readers will note that we use different figures. What gives? As with many points, determining these costs is open to interpretation.

What is not open to interpretation, however, is the fact that nuclear power produces about 20 percent of America's electricity. Wind generates a fraction of one percent. Whether nuclear power is an economic method to produce electricity or not is something I am happy to let the market decide. Same with wind and other renewables. So far, the market is making a very definitive statement about the relative merits of these technologies.

The authors hint at wind and solar's problems. Because the wind doesn't always blow and the sun doesn't always shine, the power to be derived from these can be intermittent and unreliable. (They do not point out, though, the flipside, which is that the obvious advantage to nuclear is that it can provide huge volumes of high-grade and absolutely reliable power around the clock.) But they dismiss this, arguing as if it is just a minor problem to be tweaked. And how to do that? No problem. Just "develop . . . new energy storage facilities," as if this were as easy as building a huge storage tanker to hold electricity generated when the wind is blowing hardest and the sun shining - brightest.

But it doesn't work that way. Electricity cannot be stored like coal or gas. It must be generated essentially at the time of use. The idea of a large-scale storage facility for electricity is something akin to cold fusion or the perpetual-motion machine: wonderful ideas, but existing only in the imagination. Messrs. Makhijani and Smith hold out pumped hydropower as an example of storage, where "wind and solar electricity can be used to pump water into existing reservoirs, from which hydroelectricity could be generated during periods of insufficient sunlight or wind." But there is something of a Rube Goldberg feel to pumped hydropower, which requires two different reservoirs at varying heights, massive quantities of water, and hydropower turbines to generate electricity, in addition to the large-scale wind facilities or massive solar panels that would be needed to power pumps to move the water from the lower reservoir to the upper one. Such a system would require huge amounts of space. Is this really a practical and economical answer to meeting the challenge of greatly increased electricity demand in the coming decades, not to mention supplanting any electricity already being generated by nuclear power or coal?

The authors' other objections to nuclear power center on the risks of proliferation as well as the possibility of a nuclear accident. These are not illegitimate concerns, and they have been with us since the dawn of the nuclear age. We could decommission every commercial nuclear energy plant in the United States tomorrow, however, and we would still face a serious proliferation threat worldwide. The nuclear genie is out of the bottle, to use the old cliché, and there is no putting it back. (And that would have been the case had there been no Manhattan Project and had the United States foresworn pursuing creation of an atomic weapon. The Nazis or the Soviets certainly would have developed one, given enough time.) The emergence of the threat posed by a nuclear Iran or North Korea owes much more to the malign ambitions of evil regimes and the impotence of international institutions such as the United Nations, the International Atomic Energy Agency, and the Nonproliferation Treaty, than to the inherent dangers of nuclear fission. The IAEA has effectively abdicated its responsibility to police the nuclear arena, and the world is far less safe as a result. As such, nonproliferation must be among the very highest priorities for every American presidential administration.

The possibility of an accident at a nuclear plant, similarly, is not to be dismissed out of hand or taken lightly. This is particularly the case, as the authors point out, if we see a widespread construction of new nuclear plants around the world in the coming decades. Still, one thing they failed to mention is that nuclear power has experienced huge advances in operational safety since Three Mile Island. Part of this is the result of safety procedures mandated by the Nuclear Regulatory Commission. Part is due to self-regulation on the part of industry. Part is the product of improvements and efficiencies in modern technologies after a quarter century. All the newest next-generation nuclear research around the world is aimed at developing systems that are safer and more resistant to proliferation than the ones presently in use.

No energy technology is without risks. Nuclear is no exception. The questions are whether the benefits outweigh its risks and whether it outperforms the alternatives. In the case of nuclear energy, the answer to both questions is yes

Brice Smith and Arjun Makhijani respond to the article by Max Schulz, "Nuclear Power is the Future."

In his article, "Nuclear Power Is the Future," Max Schulz claims that there would "be little controversy over splitting the atom" if cost were the only consideration. But he failed to add up all the costs. His figure of 1.8 cents per kWh ignores the most important cost element: capital cost. By the same argument, wind power would cost only half a cent per kilowatt hour. When capital cost is included, the total cost of electricity from new nuclear plants is between 6 and 7 cents per kWh. This was the conclusion of studies published by MIT in 2003 and by the University of Chicago in 2004, both of which advocate nuclear power. In fact the authors of the MIT report concluded that nuclear power would not likely be a sound choice for a merchant plant because it would be "just too expensive." That's the main reason the nuclear industry hasn't ordered a plant in over a quarter of a century—they've been waiting for the kind of government subsidies enacted by Congress in 2005.

Schulz's claim that electricity from renewable energy can cost from two to six times as much as nuclear power is also incorrect. Estimates from 2005 from both the National Renewable Energy Laboratory and the Energy Information Administration put the cost of electricity from wind power at favorable sites at between 4 to 6 cents per kWh. This already makes wind power cheaper than new nuclear power, and projections are that the cost of wind will continue to fall. In addition, as we noted in our original article, the cost of new advanced thin-film solar panels is expected to fall to a level that would make them economically competitive with new nuclear plants.

Schulz deals with reactor safety by saying: "God willing, Three Mile Island will be remembered as the worst accident in American history." Faith-based analysis is a dangerous way to address the problem of earthly risk and engineering realities. For instance, a U.S. government analysis, carried out by Sandia National Laboratory and entitled *Calculation of Reactor Accident Consequences for U.S. Nuclear Power Plants*, concluded that a worst-case accident could kill tens of thousands of people and cause hundreds of billions of dollars in damage. It is this potential for accidents at nuclear plants to cause massive casualties and for the effects of radioactive contamination to impact future generations that set nuclear accident risks apart. While it is true that the probability of such a worst-case accident occurring is very small, the exact risk is not well known. As we noted in our article, risk assessments have numerous methodological weakness that contribute significantly to the uncertainty of their results. One sure thing is that a major expansion of nuclear plants around the world would increase those risks. From our calculations using historical data, the construction of 2,500 nuclear plants, even if they were 10 times safer than existing plants, would make it likely that there would be two Three Mile Island scale accidents in the next 40 to 50 years. The inclusion of terrorist threats to this analysis would only heighten the potential risk.

Schulz never once addresses the issue of the proliferation risk of uranium enrichment. This is a surprising omission given the current crisis over Iran's attempted acquisition of uranium enrichment capacity and the fact that the most recent crisis with North Korea flared up over a U.S. conclusion that they had begun a secret uranium enrichment program in violation of the Non-Proliferation Treaty. All light-water reactors require enriched uranium as fuel. In addition, the Pebble Bed reactor, touted as more proliferation resistant by Schulz, will require uranium fuel enriched to an even higher degree than that required for light-water reactors, making it more proliferation prone in that respect, since it would take even less work to turn Pebble Bed reactor fuel into weapon-grade material. Overall, in order to fuel 2,500 reactors, there would have to be a nearly six fold increase in global enrichment capacity. This would be equivalent to over 300 enrichment plants the size of the proposed Iranian facility at Natanz. The expansion of the world's uranium enrichment capacity on such a scale would pose very significant security risks.

Schulz mentions reprocessing in a hopeful tone; he never refers to North Korea, which used a small commercial reprocessing plant to become a nuclear weapon state. It had already credibly claimed to be one at the time he wrote his article. Perhaps the North Korean nuclear test will cause him to re-evaluate his position, since that dictatorship showed the great powers as helpless Gullivers, tied down by the threads of the atom they unleashed.

Finally, nuclear waste—Schulz characterizes the delays in the Yucca Mountain repository as resulting from "[p]olitical squabbling." He ignores the very real deficiencies of the site: seismic and volcanic activity in the region and an oxidizing geochemical environment creates the risk that the waste packages will corrode rapidly—in hundreds of years or perhaps thousands—leaving the waste seeping through the porous rock into the groundwater. With all the scientific, political, and legal hurdles facing Yucca Mountain, Ernest Moniz and John Deutch, the two co-chairs of the MIT study and both former undersecretaries in the Department of Energy, concluded in January 2006 that "it is unclear whether Yucca Mountain will ever receive a license from the Nuclear Regulatory Commission."

It has been more than 50 years since the birth of the nuclear power industry, which still needs a massive presence of government in the marketplace. Nuclear power had its chance, and created an expensive mess that will endure for many generations. It is time to move on from faith-based solutions to energy and global warming problems to more rapid, robust, and sustainable options: Efficiency, conservation, renewable resources, and some types of transition technologies are capable of completely meeting our future energy needs. The alternatives are available if we have the will to make them a reality.