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Nuclear Power: Should it have a role?

ADEQUATE MITIGATION OF THE RISKS of climate change requires rapid displacement of fossil fuels with carbon-free energy sources. This imperative has prompted a growing chorus of energy analysts, policy makers, and industry advocates to press for a resurgence of nuclear energy. Even some environmentalists are urging reconsideration of the nuclear option, so long anathema to their own movement. Yet, with critical problems unsolved — safety and cost, waste storage, and nuclear weapons proliferation — nuclear power remains a deeply problematic response to the climate challenge, and to the wider challenge of global sustainability. Therefore, the transformative energy strategy of a Great Transition relies on three major prongs: renewable resources, deep efficiency, and a model of development based on environment-sparing consumption and production patterns.

GTI PERSPECTIVES ON CRITICAL ISSUES

The Great Transition Initiative is an international group working for a planetary civilization rooted in solidarity, sustainability, and human well-being. With this long-term goal as our frame of reference, GTI Perspectives assess pressing near-term policy questions.

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Context

As the imperative to diminish the grave risks posed by climate change grows more urgent, attention turns to ways to rapidly reduce fossil fuel use, the primary source of carbon-dioxide emissions. In particular, many energy analysts, policy makers, and industry spokespersons are advocating a major expansion of nuclear energy. Even some environmentalists reluctantly have joined the chorus, abjuring the nuclear skepticism long a part of the environmental tradition.[1]

A resurgence of nuclear energy would be a reversal of fortune for a moribund technology. In the decades since the accidents at Three Mile Island and Chernobyl, construction of new plants largely stagnated, especially in industrialized countries. Today, 438 reactors generate about 14 percent of the world's electricity. But with 44 new plants under construction (primarily in China, Russia, India, and South Korea) and others in planning, some forecasters predict a sharp uptick in nuclear power.[2]

Yet, for nuclear energy to contribute to a significant degree to greenhouse gas abatement, the rate of construction would need accelerate vastly. Offsetting even 10 percent of total global carbon emissions by 2050 would be an immense undertaking, requiring some 2,200 new plants, or more than one per week in the coming decades.[3] However, the nuclear power option faces a set of vexing problems that should temper enthusiasm for an expansion of this scale.

Safety and Cost

Although no plant design can be risk-free, new research has brought claims of a new generation of nuclear reactors with advanced safety features. However, they have yet to be tested at full scale, and all reactors now on order use conventional technology. Moreover, nuclear power plants are now considered plausible targets for terrorist attacks. Whether caused by accident or malice, a sudden dispersal of radioactivity would have severe community impact, perhaps exacerbated by inadequate evacuation plans. If such an event triggered a renewal of anti-nuclear sentiment in the general public and led to demands for a nuclear moratorium, the resilience and sustainability of the energy system would be greatly compromised.

The full economic costs of nuclear energy are difficult to determine. A comprehensive accounting would include accident insurance, safety assurance, decommissioning, and radioactive waste disposal — costs that are often buried in generous public subsidies for the nuclear industry or shifted to future generations. As the experience in the U.S. with the first wave of nuclear plants indicated, projected costs can soar as the full costs of the nuclear fuel-cycle are reflected in the price of electricity. Of course, high costs might not be a key issue if nuclear power were the only option for climate mitigation. It is not.

Waste Storage & Uranium Recycling

The need to safely dispose of long-lived, highly radioactive waste for tens of thousands of years poses daunting technical challenges. Indeed, as no country has yet implemented a functioning long-term waste repository, much of the world's inventory of waste remains sequestered in temporary casks at dispersed plant sites. It requires considerable technological optimism to be sanguine about finding satisfactory geologic repositories: 2,000 reactors would require new capacity the size of the controversial Yucca Mountain storage site in the United States every few years into the foreseeable future.[4] It is difficult to imagine that this level of storage capacity could be found and activated. Indeed, after 20 years and $9 billion of investment,the Obama administration has declared Yucca Mountain "not an option."

"Wide deployment of nuclear power would increase the risk of weapons proliferation."

Such a waste burden would diminish if production eventually shifted from conventional once-through light water reactors to advanced closed-fuel-cycle plants, where spent fuel is reprocessed and re-used. Indeed, some analysts project that uranium reserves will be depleted in the coming decades, making fuel reprocessing and reuse mandatory.[5] However, reprocessing nuclear waste would create massive quantities of weapons-grade material (such as plutonium), bringing increased risk of diversion by atomic terrorists, rogue states, and malevolent individuals.

Proliferation and Security

Nuclear power cannot be decoupled from nuclear weapons. Two paths lead from a nuclear energy program to weapons-grade material; one involves uranium and the other plutonium. For use as a nuclear fuel, naturally occurring uranium undergoes enrichment to increase the concentration of the fissionable U-235 isotope, and further enrichment can produce weapons-grade material. Consequently, a wide deployment of nuclear power and associated technology would increase the risk of nuclear weapons proliferation. This link is underscored in today's headlines on disputes over enrichment programs in North Korea and Iran, putatively for electricity generation, possibly for more.

Another pathway from nuclear power to nuclear weapons would be through the recovery of plutonium from spent uranium fuel, either directly or as a by-product of re-processing. A mere six kilograms of such highly fissible plutonium is needed for a simple nuclear weapon, and much less to fabricate a dirty conventional bomb. At the large scale of nuclear generation under consideration, it would become extremely difficult to track and secure the movement of such small amounts of material.

Nuclear Power Deflects Us from the Path to Sustainability

The transition to a stable, secure, and livable future is a complex undertaking with many interlocking moving parts. We must simultaneously limit climate change, reduce cultural and geopolitical friction, address nagging social inequities, restore environmental health, create a stable world economy, and preserve scarce resources. The argument for a major push on nuclear energy focuses on only one aspect — the mitigation of carbon emissions — while downplaying the daunting and unresolved problems that the nuclear option entails.

A systemic perspective highlights these deficits, as well as possible benefits. Considering all the challenges we face, and the burdens and risks nuclear energy carries, the energy path to a sustainable, equitable, and secure future lies elsewhere. A three-pronged energy strategy is indicated. First, we must harness the massive potential of solar, wind, and other renewable resources, a goal that can be spurred through advanced research and development and appropriate policies (i.e., to reduce the use of carbon-based fuels). Second, we must launch a revolution in efficiency, e.g., reducing energy use in buildings using readily available technology, tripling automobile efficiencies, expanding mass transport, designing compact communities, and creating practices of industrial ecology that recycle materials and energy. Third, we must make human well-being, not consumption and growth, the primary metric of development. This would reduce energy needs in richer countries and allow poorer countries to leap-frog to a more advanced and ecological form of modernity. The current promotion of nuclear power deflects attention and resources from this pressing program.

With its long-term legacy of heightened risks and toxic burden, nuclear power violates a fundamental principle of sustainability: passing on a resilient world to future generations. At the least, a world laced with nuclear power plants and crisscrossed with commerce of fissionable materials would require a strong international regime of security and control, a world more consonant with an authoritarian Fortress World scenario than a Great Transition.

"The promotion of nuclear power deflects attention and resources from the three-pronged program of renewable energy, deep efficiency and low-impact consumption and production patterns."

Endnotes

1 E.g., Stewart Brand, "Environmental Heresies", *Technology Review*, May 2005 (http://www.technologyreview.com/article/16398/)

2 International Atomic Energy Agency, *Power Reactor Information System,* 2009 (http://www.iaea.org/programmes/a2/index.html); and *Nuclear Power Worldwide: Status and Outlook, 2008* (http://www.iaea.org/NewsCenter/PressReleases/2008/prn200811.html).

3 Assuming world energy grows at an average rate of about 1.6% per year to 2050, and nuclear facilities capacities average about 1200 megawatts, operate at 80% capacity factor, and displace coal-fired generation.

4 Estimate from *The Future of Nuclear Power,* MIT, 2003 (http://web.mit.edu/nuclearpower/)

5 Nuclear Information and Resource Service, *False Promises: Debunking Nuclear Industry Propaganda,* 2008 (http://www.nirs.org/falsepromises.pdf)

This Perspective reflects a broad consensus of GTI's diverse network, although a dissenting view holds that nuclear power merits more favorable consideration in light of grave climate risks. The document was prepared by Paul Raskin (Director of GTI and the Tellus Institute), Orion Kriegman (GTI Coordinator), Rich Rosen (physicist and Senior Fellow at Tellus), and Marjorie Kelly (sustainability author and Senior Associate at Tellus).

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