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After Iran: Back to the Basics on "Peaceful" Nuclear Energy

By Henry Sokolski

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If states-parties to the nuclear Nonproliferation Treaty (NPT) want to prevent countries such as Iran from using the treaty as a legal cover to acquire all they need to come within days of having nuclear weapons, they will have to return to what the NPT originally meant by “peaceful” nuclear energy.

Under Article IV of the treaty, NPT member states are assured access to the benefits of civilian nuclear energy. Read properly, Article IV recommends eschewing dangerous nuclear projects that cannot compete economically with less risky alternatives. It also means shunning, as much as possible, nuclear activities that the International Atomic Energy Agency (IAEA) cannot yet truly safeguard, that is, provide timely warning of diversions of sufficient nuclear material to make a bomb. These activities include enric hing uranium, reprocessing plutonium, and fabricating fuels derived from highly enriched uranium (HEU) or plutonium.

In the next few years, both at the upcoming NPT Review Conference and in other fora, states should consider a number of international moratoria to restrict these activities. It would be useful to hold off expanding states’ net capacity to separate plutonium, enrich uranium, or fabricate fuels that use nuclear weapons-usable materials as well as to re-examine what the IAEA requires to meet its own safeguards criteria. Given the economic and security interests at stake, securing agreement to any of these proposals will not be easy. Yet, the alternative to not trying is far worse: a world crowded with nuclear-ready states mutually suspicious of one another and primed for war.

Original Intent
Iran’s claim that it has a “peaceful” right to acquire all it needs to come within days of having a bomb should remind us of what the NPT was meant to prevent. As the diplomat who first proposed the treaty, Irish Foreign Minister Frank Aiken, explained in 1959, “a world of nuclear-ready states would resemble a town full of armed residents pointing guns at each other’s heads. At some point, mutual suspicion and the advantage of firing first would give way to mayhem.”[1]

The NPT was supposed to prevent this. In 1965, the UN General Assembly resolved that the NPT was to be “void of loop-holes which might permit nuclear or non-nuclear power to proliferate, directly or indirectly, nuclear weapons in any form.” As a result, the treaty’s negotiators rejected proposals by Mexico and Spain to make the nuclear-weapon states’ sharing of “the entire technology of reactors and fuels,” including the means to produce nuclear weapons usable materials, a “duty” under the NPT.[2]

The treaty’s negotiators understood that, although nations should be free to develop peaceful nuclear energy under the NPT, whether or not a particular activity met this criterion depended upon a number of factors.[3] First, could the activity in question be safeguarded, as the NPT required, to prevent it from being diverted “from peaceful uses to nuclear weapons”? Could the NPT’s nuclear watchdog, the IAEA, monitor it in a manner that could reliably detect the loss or theft of enough nuclear material to make a bomb before this material could actually be fabricated into an explosive?

Meeting this timely detection criteria, which the IAEA has adopted to define its safeguard procedures, is not a given and is not yet possible at nuclear facilities that handle or can quickly produce large amounts of nuclear weapons-usable fuel. Such industrial units include plutonium-separation plants, uranium-enrichment facilities, and factories that fabricate HEU- and plutonium-based fuels.

Still Beyond Safeguards
Why are inspections at such plants insufficient to safeguard against such diversions? Consider Japan’s recent experience: In

January 2003, Japanese officials admitted that their pilot plutonium reprocessing plant at Tokai-mura "lost" 206 kilograms of weapons-usable plutonium (roughly 40 crude bombs worth) over the previous 15 years. The Japanese had not diverted the material; they simply were at loss as to where this material might have gone. One popular theory is that the material was "stuck in the pipes"; another theory is that it was dissolved in chemical solution. These reported losses were in addition to the 70 kilograms of plutonium Japan previously conceded remained unaccounted for at a plutonium-based fuel fabrication plant it was operating. The British, meanwhile, have experienced similar losses at their plutonium reprocessing plant at Sellafield. There, 19 kilograms of separated plutonium went missing in 2003, and another 30 kilograms of separated plutonium were unaccounted for in 2004.[4]

All of these plants operated under the watchful eye of the IAEA.[5] This highlights two major safeguards deficiencies. First, with the unaccounted amounts of weapons-usable plutonium each year being many times what is needed to make a bomb, there is no way to be sure this material might not have already been diverted. Second, any nation operating such plants could at any time take any of the nuclear material they had produced (both accounted for and unaccounted for) and convert it into bombs well before any inspector or outside authority could intercede to block the diversion.

With commercial uranium-enrichment facilities and HEU fuel fabrication plants, which process tons of enriched uranium annually, equally hair-raising material loss scenarios are possible.[6] For example, IAEA inspectors still cannot independently verify the production capacity of any given centrifuge-enrichment plant. As such, an enrichment plant operator could lowball his facility's capacity to IAEA inspectors and, between IAEA inspection visits, covertly produce and divert enriched uranium for military purposes without being detected. Moreover, such diversions could take place without IAEA inspectors necessarily being tipped off.[7]

Then, as with plutonium bulk-handling facilities, there is the problem of how quickly a non-nuclear-weapon state could break out of its NPT obligations and make bombs with these plants. All of the facilities mentioned process materials that could be converted into bombs in weeks or less, well before any outside authority could intervene even if the diversion was detected.

With these activities, unless there is a compelling economic need to proceed, there are obvious security imperatives for holding back. Clearly falling into this category are the reprocessing of plutonium, the fabrication of plutonium- and HEU-based fuels, and HEU production. All of these nuclear activities generate or handle nuclear weapons-usable materials, are not essential to having civilian nuclear power, and in most cases are sure-fire money losers.

In contrast, lightly enriching natural uranium to contain 3 percent to 5 percent uranium-235 is required to fuel the world's light-water reactors.[8] What is unnecessary, however, is to expand the current surplus of enrichment capacity, which is more than able to supply world demand for at least the next 10-15 years. Given that it takes no more than five years to build substantial, additional enrichment capacity, the time for any nation to build or invest in creating more net capacity is still at least five to 10 years away.[9] That is why both President George W. Bush and IAEA Director-General Mohamed ElBaradei have proposed restricting the construction of new enrichment plants.[10]

Certainly, there is no economic justification for nuclear novices such as Iran to enrich uranium. Tehran has only one nuclear power station that requires lightly enriched uranium fuel, and Russia has promised to supply Iran with all the enriched uranium it needs for the entire lifetime of the reactor.[11] Separate from the matter of Iran's trustworthiness—even after two years of intensive investigations, the IAEA has not yet been able to say whether Tehran is or is not in the bomb-making business—Tehran's operation of an enrichment plant is neither safeguardable nor economically defensible. As such, this undertaking should be regarded as being neither peaceful nor protected under Article IV of the NPT.

Measures for the NPT Review Conference—and Beyond

Again, if Iran has a legal right to acquire such unnecessary, unsafeguardable nuclear facilities, what would keep Tehran's neighbors from following suit and becoming nuclear weapons ready as well? Indeed, what would prevent the world against which ElBaradei has repeatedly warned from emerging, one with 20 or more states only weeks from a bomb, all primed to believe their nuclear capabilities might keep them safe? We know where the military build-up and mutual suspicions of 1914 led: World Wars I and II and more than 100 million dead. Do we want a world with nuclear weapons-ready contestants stretching not just from Russia to the United States, but from Algeria to Japan?

If we wish to avoid the worst, we should back the NPT's original presumption in Article IV against the unnecessary spread of unsafeguardable nuclear activities and materials. During and after the NPT Review Conference, states should consider proposals to put the original view of Article IV into play for nuclear-supplier and nuclear-recipient states alike and, to the extent possible, for nonmembers of the NPT as well. This will be both new and difficult.[12] If we want an NPT that restrains rather than enables proliferators, however, one or more of the following minimal steps should be taken sooner rather than later.

An indefinite moratorium on expanding plutonium, HEU, and MOX production

A good first step would be to institute an indefinite moratorium on the expansion of states' existing capacity to produce separated plutonium, HEU, or plutonium-based reactor fuels for civilian purposes. This moratorium should stand in place until

methods can be devised to provide appropriate timely detection and warning of diversions from existing plants.

As Bush and ElBaradei noted in their proposals to restrict construction of new plutonium reprocessing facilities, making separated plutonium is unnecessary for the peaceful production of nuclear energy. This also applies to HEU use in civilian reactors. Bush proposed a freeze on any construction of reprocessing and enrichment facilities in countries that do not yet have "full-scale" operational plants already on line. ElBaradei proposed a universal freeze but one that would only last for five years.

There are several reasons, beyond fairness and credibility, for modifying their proposals to apply indefinitely against the expansion of plutonium, HEU, or mixed oxide (MOX) production anywhere. First, reactor fuels using recycled plutonium cannot begin to compete with less expensive, fresh low-enriched uranium fuel. Second, research reactors that once required nuclear weapons-useable HEU can be converted to use less dangerous low- enriched uranium. That is why the Department of Energy is trumpeting its Global Threat Reduction Initiative and its recent agreement with Russia to repatriate HEU used in U.S.- and Russian-origin research reactors and to convert these reactors to use low-enriched uranium. It is also why the United States and Germany no longer reprocess plutonium, why the United Kingdom has announced its decision to end its recycling efforts within the next five years, and why there is no immediate prospect of Russia expanding its recycling activities.

As for the planned expansions of commercial plutonium recycling activities, there are only two projects that would be affected by this freeze. The first is Japan's controversial plans to open a large, commercial-scale reprocessing plant at Rokkasho-mura, which has been opposed on ecological, safety, and economic grounds by local residents and Japanese reactor utility officials. With existing IAEA safeguards methods, this facility will be difficult to monitor. Once this plant goes online, perhaps as much as 250 kilograms of weapons-useable plutonium might get "lost in the pipes" annually—enough for 50 crude bombs.

The second project is a U.S. government scheme to convert 34 tons of surplus weapons plutonium (now in the form of metal) into ceramic powder and mix it with uranium to make MOX fuel. The MOX fuel is to be burned in U.S. civilian reactors with the hopes of making it too radioactive to be easily stolen. To support this effort, the Energy Department is using billions of U.S. taxpayers' dollars to have a French nuclear firm construct a MOX fuel-fabrication plant in South Carolina. Eventually, the plan is to have the Russians do the same.

Besides being clearly uneconomical, this program is a bomb-material-monitoring nightmare. First, it is relatively easy to convert fresh MOX fuel into bombs. Each 100 kilograms of MOX contains one crude bomb's worth of plutonium. That is why the IAEA lists MOX as being "direct use" nuclear material (i.e., material able to bring its owners nearly as close to a bomb as if they had separated plutonium or HEU). The program plans to take about 20 years to dispose of 68 tons of the plutonium the United States and Russia have declared to be in surplus, and this is only a fraction of what Russia and the United States have on hand. Throughout this period, the challenges of detecting nuclear theft or loss will actually be higher than it would be if the plutonium remained safely stored. In contrast, freezing this project, which is already behind schedule, would spare further immediate spending, provide a better opportunity to address safeguards challenges, and allow more time to research and develop sounder alternatives such as immobilization.

A five-year, renewable moratorium on expanding net enrichment capacity

Another useful step would be for countries to agree on a five-year, renewable international moratorium on the expansion of any state's net enrichment production capacity. This freeze should stay in place until the economic imperative to lift it can be demonstrated by the investment of private capital to provide full funding for any expansion without government guarantees, subsidies, or specific relaxation of existing safety regulations.

As ElBaradei has said, the world currently enjoys a surplus of enrichment capacity. Even by conservative estimates, existing international enrichment capacity will be able to supply demand for at least the next decade or more. This is why ElBaradei proposed a five-year moratorium on the construction of any additional enrichment plants and Bush recommended banning countries that currently lack such facilities from ever enriching. Given that some states want to upgrade their existing gaseous diffusion enrichment plants with more modern centrifuge facilities, however, neither of these proposals is gaining much support. A moratorium on expanding net enrichment capacity could help get around this issue. It would allow states to modernize the enrichment facilities they have but would keep them from expanding their overall capacity to enrich.

What enrichment expansion efforts would be affected? The first would be the Brazilian government's controversial enrichment project at Resende. The IAEA is still weighing whether or not to approve the method Brazil proposes for the agency to safeguard the facility. In any case, expansion of Brazil's uranium-enrichment production capacity is on a relatively slow track. Even by the most optimistic estimates, the Resende plant is not expected to be able to supply Brazil's two working reactors fully anytime before 2014.[13] Given the future costs of completing the plant as compared to continuing to buy foreign fuel services, keeping this project frozen would actually save Brazil money.

The second effort that would be affected would be Japan's planned expansion of its enrichment capacity by nearly 50 percent.

This government-backed undertaking has already slipped several years, partly because of the ready availability of affordable foreign sources of enriched uranium. China, meanwhile, has built several new plants but also has shut down two less efficient gaseous diffusion plants. Finally, France and Canada are in various stages of planning to construct enrichment plants. None of these plans, however, threatens any immediate increase in these nations' net enrichment capacity.

Finally, two U.S. projects would be affected. The United States Enrichment Corp. (USEC) wants to build a large, centrifuge enrichment plant in Ohio that could be operating by the end of the decade. The company took over what were previously U.S. government-owned gaseous diffusion enrichment plants. USEC seeks to upgrade its existing services, which already supply fresh low-enriched reactor fuel to 100-odd U.S. nuclear power reactors. Because the new centrifuge project is projected to cost the company more than $1 billion, however, stockholders want more information before making the dive. To get this, the company is pushing to build a pilot demonstration plant. The only serious competition to USEC is URENCO, a Dutch-based firm that is trying to muscle into the U.S. market with plans to build a centrifuge enrichment plant in New Mexico. Both the UNRENCO and the USEC projects require U.S. licenses, which have not yet been granted.[14]

Clearly, a renewable moratorium is feasible. Its successful implementation would require a majority of the key suppliers of enriched uranium to participate. Also, any such moratorium would have to allow for the possible expansion of uranium-enrichment capacity in five or more years if such growth could be funded with private investment without government subsidies or guarantees or a relaxation of safety regulations. A related issue would be the rate at which Russia and the United States agreed to blend down surplus HEU for use in civilian reactors, as well as the amount. The higher the rate and amount, the lower the demand would be for near-term, enrichment capacity expansion.[15]

An indefinite freeze on transfers of nuclear weapons-useable materials

One could also complement the proposed moratoriums with an indefinite freeze on international transfers of HEU or separated plutonium. Such transfers would be banned unless the transfer's purpose was to dispose of the material or to make it less accessible for weapons. Implementing such a freeze would be particularly important given Iran's publicly expressed interest in sharing the fruits of their "peaceful" nuclear energy programs with others. It also is relevant given Pakistan's illicit commerce in such commodities and the need to strengthen the authority of states to interdict trade in strategic weapons-related goods generally. Again, the peaceful use of nuclear energy does not require these nuclear weapons-useable fuels.

Reassessment of IAEA safeguards

Almost all of the IAEA's current criteria for how much material is required to make a bomb and how long it takes to convert key direct use and special nuclear materials (e.g., lightly enriched uranium, HEU, MOX, separated plutonium) into nuclear weapons were set more than 30 years ago. At the time, the IAEA said 8 kilograms of plutonium was required to make a bomb. Yet, with the release of previously classified information, we now know that even the United States' first bomb required no more than 6 kilograms and that a Hiroshima-yield weapon could be made with as little as 2-4 kilograms, depending on the sophistication of the bomb design.[16]

Similarly, lightly enriched uranium and spent reactor fuel were not considered to be major proliferation concerns 30 years ago. It was assumed it would take at least a year to convert fresh fuels into bomb-usable fuel and up to three months for spent fuel. As a result, the IAEA decided to inspect fresh and spent reactor fuel only once every 90 days. The experience of Pakistan's Abdul Qadeer Khan and of Libya, however, appears to show that a country can develop covert enrichment or reprocessing facilities without necessarily being detected. In addition, Iraq's and Libya's bomb programs demonstrate that states can develop or acquire a working nuclear weapons design well before they produce any nuclear fuel. Finally, only recently has the weapons utility of power reactor fuel been fully documented or credible scenarios for the diversion of safeguarded spent and fresh reactor fuel been spelled out.[17]

These developments make the risks previously associated with spent and fresh reactor fuel much greater. Consider: If a country had a working bomb design and was able to make nuclear fuel covertly, its operation of a safeguarded light-water power reactor would give it access to tons of fresh and spent reactor fuel that it could seize or covertly divert to make a large number of bombs in a matter of weeks.

The fixes for these worries include installing near real-time, secure, wide-area surveillance cameras and placing full-time inspectors at each reactor site. These measures, however, cost money that would require the IAEA to change how it funds its safeguards operations. To highlight the need for these and other needed reforms, a reassessment of the agency's safeguards system should be instituted.

Encouraging non-nuclear alternatives

All of the previous steps assume that states must expand their use of nuclear energy. This might or might not be true. To help find out, it would be useful for the United States and other like-minded states to encourage countries to weigh the economic benefits of nuclear power and non-nuclear alternatives. Under this effort, all states would be encouraged openly to compete

nuclear programs against alternatives that might produce similar benefits for less.

A good place to start for the United States would be to implement existing law. Under Title V of the U.S. Nuclear Nonproliferation Act of 1978, the United States is "to cooperate with other nations, international institutions, and private organizations in establishing programs to assist in the development of non-nuclear energy resources…and shall seek to cooperate with and aid developing countries in meeting their energy needs through the development of such resources." As a part of this effort, the United States, in cooperation with other organizations and states, is also supposed to evaluate the "energy alternatives of developing countries, facilitate international trade in energy commodities," and complete "country-specific energy assessments."

Although the president is required by law to report to Congress annually on the progress and funding of this Department of State-coordinated initiative of the Energy Department and the Agency of International Development, to date no report has been filed. Congress should find out why and demand that the law be upheld.[18]

Encouraging states that are planning large nuclear projects to compete them against less risky alternatives is most readily done in the energy field where the international practice of open bidding is already established. Even large research and desalinization reactors projects though can be competed against alternatives that might afford the same benefits (small research reactors, access to foreign research reactors, importation of research isotopes, non-nuclear desalinization systems, etc.). States may well object that they should not be subject to such requirements, citing their sovereign rights, but most nations have already ceded such ground on more significant economic matters to international organizations such as the World Trade Organization, the International Monetary Fund, and the World Bank.[19]

More proposals, of course, could be suggested. These, however, are indicative of what is required. In each case, the NPT Review Conference could evaluate the merits of instituting or, if they were adopted, of extending each of these undertakings every five years. This would give the conference useful operational issues with which to grapple. More important, adopting one or more of these proposals would go a long way to making Article IV and peaceful nuclear power meaningful (i.e., to achieving the NPT's ultimate purpose). The alternative is to wait not only for more Irans, but the clear undoing of the NPT.

ENDNOTES

1. See "Statement by the Irish Foreign Minister, November 13, 1959," *Documents on Disarmament 1945-1959*, vol. 2 (Washington, DC: U.S. Government Printing Office (GPO), 1960), pp. 1520-1526.

2. For a different view, see UN General Assembly Resolution 2028 (XX) (Nov. 19, 1965), reprinted in U.S. Arms Control and Disarmament Agency (ACDA), *Documents on Disarmament 1965* (Washington, DC: GPO, 1966), pp. 532-534; "Statement of the Representative of Mexico to the Eighteen Nation Disarmament Conference," ENDC/PV.331, September 17, 1967, reprinted in ACDA, *Documents on Disarmament 1967* (Washington, DC: GPO, 1968), pp. 397-398; "Spanish Memorandum to the ENDC Co-Chairman," ENDC/PV.361, February 8, 1968, in ACDA, Documents on Disarmament 1968, pp. 39-40.

3. See Eldon V. C. Greenberg, *Plutonium and the NPT* (Washington, DC: Nuclear Control Institute (NCI), 1993), which is based on a more detailed analysis on the NPT done for the ACDA. See Albert Wohlstetter et al., *Towards a New Consensus on Nuclear Technology*, ACDA Report no. PH-78-04-8323-13, July 6, 1979.

4. See Sudip Kar-Gupta, "Plutonium 'Missing' From Site," Reuters, February 17, 2005; Angela Jameson, "Sellafield 'Lost' Plutonium," *Times Online*, February 17, 2005.

5. See Bayan Rahman, "Japan 'Loses' 206 Kg of Plutonium," *Financial Times*, January 28, 2003; NCI, "Enormous 'Plutonium Gap' at Japan's Tokai Plant Highlights Proliferation Risks of Reprocessing," January 28, 2003; NCI, "Astounding 'Discrepancy' of 70 Kilograms of Plutonium Warrants Shutdown of Troubled Nuclear Fuel Plant in Japan," May 9, 1994 (press release).

6. In the case of at least one U.S. HEU fuel fabrication plant operating during the l960s in Apollo, Pennsylvania, the U.S. Atomic Energy Commission reported that the amount of material unaccounted for was approximately 100 kilograms. Several former senior U.S. officials suspect this material was diverted to Israel's nuclear weapons program. See Seymour M. Hersh, *The Samson Option* (New York: Vintage, 1993), pp. 241-257.

7. On these points, see Paul Leventhal, "Safeguards Shortcomings—A Critique," (Washington, DC: NCI, September 12, 1994); Marvin Miller, "Are IAEA Safeguards in Plutonium Bulk-Handling Facilities Effective?" (Washington, DC: NCI, August 1990); Brian G. Chow and Kenneth A. Solomon, *Limiting the Spread of Weapons-Usable Fissile Materials* (Santa Monica, CA: RAND, 1993), pp. 1-4; and Marvin Miller, "The Gas Centrifuge and Nuclear Proliferation," in *A Fresh Examination of the Proliferation Dangers of Light Water Reactors* (Washington, DC: The Nonproliferation Policy Education Center, October 22, 2004), p. 38.

8. Enrichment is the process of increasing the concentration of the uranium-235 isotope, which fissions far more readily than the more common uranium-238 isotope. Natural uranium is only 0.7 percent uranium-235.

9. On these points, see the supply/demand projections in International Atomic Energy Commission, Multilateral Approaches to the Nuclear Fuel Cycle, INFCIR/640, February 22, 2005, p. 51; and Jean-Jacques Gautrot, "The Harmonious Market for Uranium Enrichment Services," Presentation at the World Nuclear Association Annual Symposium, London, September 4-6, 2002, London, available at **http://www.world-nulcear.org**.

10. Office of the Press Secretary, The White House, "Remarks by the President on Weapons of Mass Destruction Proliferation," Washington, DC, February 11, 2004; and Miles Pomper and Paul Kerr, "Tackling the Nuclear Dilemma: An Interview With IAEA Director-General Mohamed ElBaradei," *Arms Control Today*, March 2005. In the interview, ElBaradei discusses the moratorium in the context of a plan to provide non-nuclear-weapons states with secure supplies of nuclear fuel.

11. In the end, Iran insisted that Russia only supply it with the first 10 years worth of reactor fuel for its reactor at Bushehr and that Iran would supply its own fuel after that. See Paul Kerr, "Iran, Russia Reach Nuclear Agreement," *Arms Control Today*, April 2005.

12 . For a projection of the sort of support such measures are likely to encounter, see Louis Charbonneau, "Iran Finds Allies Against UN Plan: Diplomats," Reuters, February 22, 2005.

13. See CNN, "Brazil's Commitment to Nonproliferation Under Suspicion," April 16, 2004; Ricardo Balthazar, "Navy Sees Full Nuclear Inspections Would Hurt Access to Foreign Suppliers," *Sao Paulo Valor*, April 6, 2004; and Daniel Koik, "Brazil Prepares to Enrich Uranium for Reactors," *Arms Control Today*, November 2003.

14. See Annys Shin, "USEC Looks for New Leadership," *The Washington Post*, December 20, 2004, p. E3.

15. See Uranium Information Center, "Military Warheads as a Source of Nuclear Fuel," November 2004, available at **http://www.uic.com**.

16. See Thomas Cochran, "The Problem of Nuclear Energy Proliferation," in *Energy and National Security in the 21st Century* ed. Patrick L. Clawson (Washington, DC: Institute for National Strategic Studies, October 1995), pp. 96-99.

17. See Harmon W. Hubbard, "Plutonium from Light Water Reactors as Nuclear Weapons Material," April 2003, available at **http://www.npec-web.org**; Andrew Leask, Russell Leslie, and John Carlson, "Safeguards as a Design Criteria: Guidance for Regulators," September 10, 2004, pp. 4-7, available at **http://www.asno.dfat.gov.au**; Miller, "The Gas Centrifuge"; and Marvin Miller, "The Feasibility of Clandestine Reprocessing of LWR Spent Fuel," in *A Fresh Examination of the Proliferation Dangers of Light Water Reactors* (Washington, DC: The Nonproliferation Policy Education Center, October 22, 2004).

18. See "United States Assistance to Developing Countries: Policy," *Nuclear Non-Proliferation Act of 1978* (P.L. 95-242), Sections 501 and 503.

19. Given the 30-year lifetime of most reactors, nuclear power proponents will undoubtedly emphasize, along with proponents of other, more expensive clean energy alternatives, long-term concerns such as energy security and global warming to help justify investment. The persuasiveness of these arguments, like those of any long-term or distant concern, however, must be weighed against the availability of cheaper ways to address the immediate desire for relatively clean energy and whether or not one has a reasonable amount of time available to buy or develop more expensive alternatives if these cheaper, "dirtier" energy sources should dry up or become intolerably expensive through regulation. As with all investment, spending delayed is money saved. Any sound market energy analysis would clearly factor in such considerations.

Henry Sokolski is executive director of the Nonproliferation Policy Education Center, a Washington, DC-based nonprofit educational organization. He is also co-editor with Patrick Clawson of Getting Ready for a Nuclear Ready Iran (forthcoming).

Washington, DC 20036
Tel: (202) 463-8270 | Fax: (202) 463-8273