

CHAPTER 14

MARKET-BASED NUCLEAR NONPROLIFERATION¹

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A world full of nuclear weapons-ready states is not inevitable. Nor does avoiding this fate necessarily require massive new government spending programs; development of new, advanced technology; negotiation of new international treaties; or any heroic military maneuvers. It will, however, at a minimum, require that the United States and other states with nuclear power programs to do two things they should have done long ago but have yet to tackle seriously – identify the full costs of nuclear power as compared to its nonnuclear alternatives, and make nuclear power operators obtain as much private financing and insurance as possible to pay for these expenses.

This requirement may seem unusual, but given the increasing political imperative to make the right choices to avoid global warming in the cheapest quickest manner, the United States, the European Union (EU), and many other countries already have good reason to begin to take such steps. In fact, identifying the full cost of nuclear power as compared to its alternatives will be difficult to avoid as we move toward a carbon-constrained world with serious carbon taxes. Certainly, if we fail to identify these costs – including all the direct and indirect subsidies, and the security and environmental costs that have yet to be internalized – then imposing such taxes will simply propel nuclear power much further both here and abroad than would otherwise be the case.

On the other hand, identifying all costs of nuclear power and doing the same for its alternatives would go a long way to assure that any energy choices that are made would be reached on the basis of sound economic comparisons rather than political whim. Given the potential for using peaceful nuclear programs for military purposes, a state that chooses nuclear power over much cheaper, emission-compliant alternatives should set off both economic and security alarms.

To secure the full benefits of this approach ultimately requires taking a second step—getting private banks and insurers to bear much more of nuclear power's full costs. To a great extent, we already do this for most non-nuclear forms of electricity. Yet, governments both here and abroad have held off doing this out of concerns that the nuclear industry, after nearly a half-century of government funding and support, is not quite yet mature enough to be subjected to such market demands. In some respects, this has actually kept the nuclear industry from doing its best. Certainly, if nuclear power had to cover all of its insurance costs against accidents and security, the industry would literally place a much higher premium on building and operating only the most modern and safest plants and do even more on their own (rather than wait for government regulation) to physically secure their plants.

More important, if nuclear operators had to cover most or all their costs, the most dangerous and economically uncompetitive forms of nuclear energy would have far greater difficulty proceeding as far as they have to date. Certainly, nuclear fuel making, which can bring a state within days or weeks of acquiring nuclear weapons, and large nuclear reactor projects in the energy-rich and unstable regions of the

world, such as the Middle East, would be much harder to sell to private investors and insurers than almost any non-nuclear alternative.

Few, in or out of the nuclear industry, dispute these points. It would be useful to exploit this consensus to promote some level of nuclear restraint. This is a particularly important as more and more countries use the Nuclear Nonproliferation Treaty (NPT), the example of the United States, and the nuclear power practices of other states as justifications to engage in the most uneconomical and dangerous nuclear activities themselves. What will be required to discipline such dangerous enthusiasm? Public recognition and emphasis of the following points:

1. *Nuclear energy is not just another way to boil water.* Spreading nuclear power reactors worldwide with nuclear cooperation agreements, generous government-backed export loans, and guaranteed financing is a surefire way to increase the number of nuclear weapons-ready nations. Unfortunately, even “proliferation resistant” light water reactors require tons of low enriched fresh fuel to be kept at the site, and they can also produce scores of bomb’s worth of weapons-usable plutonium that is contained in the reactor’s spent fuel. Research commissioned by my center, which was subsequently authenticated by experts at our national laboratories and the U.S. State Department, details just how little is required to take these materials and convert them into weapons fuel.

Under one scenario, a state could build a small, covert reprocessing line, divert spent fuel without tipping off International Atomic Energy Agency (IAEA) inspectors, produce its first bomb’s worth of material in less than 2 weeks, and continue to make a bomb’s worth of material a day.² There is no technical fix in

sight for this problem for decades or, perhaps, ever. Even the Global Nuclear Energy Partnership (GNEP), which originally claimed it could develop nearly “proliferation proof” fuel-cycles, no longer makes this claim and it warns against spreading its “proliferation resistant” UREX system to nonweapons states for fear it too might be diverted to make bombs.³ What this means is that large nuclear reactors and even light water reactors ought not to be for everyone; they should only go to those states that we can be confident are out of the bomb making business and that can make a compelling case for the economic profitability of these activities.

2. *Adam Smith’s “Invisible Hand” is trying to help us* since the most dangerous nuclear activities—fuel making and large reactors in energy-rich regions of the Middle East—are also the most economically uncompetitive when compared with their alternatives. Rather than fight this natural and helpful selection of the financially and economically fittest by pushing government-guaranteed financing for nuclear exports and government-funded nuclear commercialization projects, states interested in pursuing nuclear programs should rely far more on private firms to finance and insure nuclear and non-nuclear power projects and allow these firms to determine which of these projects is the most cost effective.

3. *Pushing government-backed nuclear sales and subsidized fuel assurances can be self-defeating both for nonproliferation and nuclear power’s own long-term health.* Backing the construction of large nuclear reactors in Libya, Jordan, Egypt, the United Arab Emirates (UAE), and Turkey (as the United States is currently doing) and the construction of similar plants in Saudi Arabia and Yemen is not only uneconomic in the near and mid-

term when compared with developing fossil-fuel-fired alternatives, but could prompt a not-so-peaceful nuclear competition in one of the world's most war-torn regions. The nuclear industry may initially benefit from the construction of a few additional reactors, but the security fallout from any war in this region could eliminate these gains.⁴ As for extending fuel assurances to nations that do not currently make their own fuel, these offers, if not properly conditioned, could increase the pace of proliferation. This is particularly so if they are designed to deal less with narrowly defined "market disruptions" caused by natural disasters, breach of contract, and terrorism than to make fuel "affordable." In fact, some nuclear fuel market observers believe that nuclear ore and fuel products are about to come into much more demand even if the world's current fleet of nuclear reactors does not expand. Their projections focus on how relatively cheap Russian blend-down uranium, and U.S. surplus uranium supply fuel contracts, and older, lower cost fuel contracts associated with terminated reactor projects are about to run out over the next few years. Meanwhile, the licensed operating-lives of many reactors are being extended by 20 or more years. As a result, uranium prices jumped significantly in 2007 and 2008. Such price spikes, nuclear fuel market experts argue, could easily reoccur in the future.⁵

Fuel assurances or fuel banks ought not to be designed to address such market trends. Certainly, if they emphasize the need to assure affordable fuel and financial incentives, they will act on nuclear proliferation much as throwing kerosene on a smoldering fire might—as an accelerant rather than as a moderator. Much like a loss leader in a department store, the effect of such subsidized assurances will be to get more

nations interested in acquiring reactors that might not have otherwise.

With the reactors will come all the nuclear training, which will not stop at just lessons on running nuclear power plants. Indeed, even as the IAEA develops its own fuel bank proposals to reduce the need for nations to make their own nuclear fuel, the Agency is adamant that no nation should give up what it currently believes is their natural right to do—make nuclear fuel. This means that any nation that might take advantage of fuel assurances could, at any time, change its mind and proceed to make nuclear fuel.

Finally, even narrowly defined assurances once offered are likely to prompt demands for more generous subsidized assurances later. For these reasons, it is important that any effort to back the further development of fuel assurances stay clear of any effort to make nuclear fuel more affordable or to encourage the development of financial incentives to get nations to avail themselves of such assurances. Draft legislation, which Senators Dick Lugar and Evan Bayh developed, is careful to avoid any encouragement of any financial subsidies, and furthermore helps the IAEA meet its safeguarding mission as well. Neither does it rush to fund any specific fuel assurance option as there are several still under development. These desirable features make sense.⁶

4. *Nuclear operators should pay the full costs of engaging in dangerous nuclear activities.* Fortunately, the nuclear activities that are most dangerous—making nuclear fuel and making nuclear power in regions where there is ready access to natural gas and oil—are also the most difficult to economically justify as compared to their nonnuclear alternatives. Internalizing as many of the external security costs associated with

operating such plants would help to keep this so. Since civilian fuel making is virtually indistinguishable from bomb fuel making, it would make sense to demand that physical security requirements for such plants be equivalent to that of nuclear weapons facilities. These additional costs should be borne by the owners of these facilities. Even the IAEA's own safeguards reviewers admit that nuclear fuel making cannot be inspected to detect diversions in a timely fashion,⁷ it would be reasonable to insist on monitoring them more extensively. Such increased monitoring—which the owners of these facilities, again, should pay for—is unlikely ever to provide for timely detection of diversions but would, at least, make detection of diversions more likely. Also, ultimately the full cost of insuring nuclear plants against attacks and accidents should be borne by their owners. The Price-Anderson Nuclear Industries Indemnity Act, which capped the amount of insurance coverage for nuclear accidents, was originally intended to last only for 10 years. That was a half century ago. All of these costs should be identified and internalized into the real costs of nuclear power. The less economic sense that paying the full costs of a civilian nuclear project makes as compared to paying the full costs of non-nuclear alternatives and the more that a government chooses nonetheless to subsidize such nuclear activities, the more international security alarms should be set off.

5. *Identifying and charging for the full costs of civilian projects should help us return to a more sane reading of the nuclear rules.* Currently, many governments (including our own) have mistakenly read the NPT as entitling nations to a per se right to any nuclear activity, no matter how uneconomic or unsafeguardable it is. This has bedeviled our dealings with nations such as

Iran. In fact, a proper understanding of the negotiating history, law, and technology of safeguards makes it clear that there is no per se right to engage in unbeneficial (read, money-losing) activities that can bring one within days or weeks of acquiring nuclear weapons. We already understand that sharing the potential benefits of peaceful nuclear explosives under the NPT has been a nonstarter because there are no economic benefits to using nuclear explosives for excavation and because a peaceful nuclear explosion is impossible to distinguish from a nuclear weapons test. The same economic and security discipline needs to be applied to the sharing of the benefits of the applications of peaceful nuclear energy.⁸ So far, members of the NPT have not been so disciplined because they see the potential security benefits of acquiring a near nuclear-weapons option through development of peaceful nuclear power. If we are serious about preventing the spread of nuclear weapons, though, we should be much more active in smoking out this motive by being much stricter about economic rationales.

6. *We have always spoken about the need to meet certain economic criteria before developing large nuclear energy programs; we need to do this more.* The French, the United States, and the IAEA have all quietly noted that nuclear power programs only make sense for nations that have a large electrical grid, a major nuclear regulatory and science infrastructure, and proper financing. The British government, after an extensive analysis, concluded last year that if carbon emissions are properly priced (or taxed), then British nuclear power operators should be able to cover nearly all of their own costs without government support.⁹ In the first Bush administration, U.S. officials rightly noted the absurdly negative economics for Iran of building

the Bushehr reactor, as well as the nuclear fuel making plant at Natanz, as compared to exploiting natural gas. Critics did the same to reverse U.S. policy in backing the building of large nuclear power plants in North Korea. U.S. bank analysts, meanwhile, are still divided over whether to invest heavily in U.S. nuclear power construction. They and the nuclear industry would feel more comfortable building new reactors if they were able to secure more government guarantees and subsidies for this work. Economic judgments and criteria, in short, have long been used by several key governments, private firms, and institutions in judging the merits of proposed nuclear projects. More can be done to more honestly cost these projects and to compare them against non-nuclear alternatives. Here, internationally, two places to start would be to back the principles contained in the Charter Energy Treaty and the Global Energy Charter for Sustainable Development. In concert, these international agreements encourage countries to open their energy sectors to fair competition and to state the full price of any energy option.¹⁰ In addition, it is not too early to consider what might be developed as a follow-on to the Kyoto Protocol after 2012. Whatever is finally agreed to here would be improved if it fostered the principles of full costing and international open-market competitions. This is also a set of principles that the G-20 ought to adopt.

7. *Promoting market-based nonproliferation is worthwhile, but it will not solve all problems.* Would a market-fortified NPT regime of this sort eliminate the problems already posed by a nuclear-ready Iran or a nuclear-armed North Korea? Unfortunately, the answer is no. Those problems can now only be dealt with by military, economic, and diplomatic efforts to

squeeze Iran and North Korea to transition to less hostile rule – such as those used against the Soviet Union during the Cold War. But the market-fortified system suggested would help prevent Iran’s and North Korea’s patently uneconomic ploys from becoming an international model of nuclear behavior for countries now professing an earnest desire to back peaceful nuclear power development. These countries include Indonesia, Libya, Saudi Arabia, South Korea, Nigeria, Egypt, Turkey, Morocco, Jordan, the UAE, and Yemen (all of which are bizarrely receiving active U.S. or IAEA nuclear cooperative technical assistance to complete their first large power stations). Also, unlike the situation under today’s interpretation of the NPT, which ignores suspicious “civilian” nuclear undertakings even when they obviously lack any economic rationale, the market-fortified system described above would help to flag worrisome nuclear activities much sooner – well before a nation came anywhere near to making bombs. Such an approach, in short, would encourage an NPT-centered world worthy of the name, a world in which the NPT would clearly restrain the further spread of nuclear weapons-related technology rather than foster it.

ENDNOTES - CHAPTER 14

1. This essay is drawn from testimony given before a hearing of The House Committee on Foreign Affairs, “Every State a Superpower? Stopping the Spread of Nuclear Weapons in the 21st Century,” held on May 10, 2007, Rayburn House Office Building, Room 2172, Washington, DC.

2. See Victor Gilinsky, Harmon Hubbard, and Marvin Miller, *A Fresh Examination of the Proliferation Dangers of Light Water Reactors*, Washington, DC: The Nonproliferation Policy Education Center, October 22, 2004, available from www.npec-web.org/files/20041022-GilinskyEtAl-LWR.pdf.

3. See Office of Fuel Cycle Management, *Global Nuclear Energy Partnership Strategic Plan*, Washington, DC: U.S. Department of Energy, GNEP-167312, Rev.0, January 2007, p. 5, where the DoE notes that

there is no technology ‘silver bullet’ that can be built into an enrichment plant or reprocessing plant that can prevent a country from diverting these commercial fuel cycle facilities to non-peaceful use. From the standpoint of resistance to rogue-state proliferation there are limits to the nonproliferation benefits offered by any of the advanced chemical separations technologies, which generally can be modified to produce plutonium. . . .

4. In 2006, 13 new, additional nations announced their intention to construct and operate large power reactors on their soil. To get some idea of how large a jump this is, one need only consider that that number constitutes a 42 percent increase in the number of nations (31) currently operating large reactors within their borders. The nations in question were Turkey, Egypt, Saudi Arabia, Libya, Yemen, Jordan, Vietnam, Australia, Bangladesh, Morocco, Tunisia, Indonesia, and Nigeria.

5. See e.g., Jeff Combs, Ux Consulting Company, “Price Expectations and Price Formation,” presentation to the Nuclear Energy Institute International, Uranium Fuel seminar, October 2006; Tom Neff (MIT), “Uranium and Enrichment: Enough Fuel for the Nuclear Renaissance?” December 2006. See presentation to the North West Power Council, “New Nuclear Reactors,” February 2007, available from www.nwccouncil.org/news/2007/02/p1.pdf.

6. See S1138, “The Nuclear Safeguards and Supply Act of 2007” introduced April 18, 2007 by Senators Lugar and Bayh, soon to be available from thomas.loc.gov/cgi-bin/query/z?c110:S.1138.

7. See, e.g., the comments of the chairman of the IAEA’s Standing Advisory Group on International Safeguards, John Carlson, Australian Safeguards and Non-Proliferation Office, “Addressing Proliferation Challenges from the Spread of Uranium Enrichment Capability,” Paper for the Annual Meeting of the Institute for Nuclear Materials Management, Tucson, July 8-12, 2007 (available

from NPEC upon request). Also see Paul Leventhal, "Safeguards Shortcomings: A Critique," Washington, DC: Policy Education Center, October 22, 2004, p. 38, available from www.npec-web.org/files/20041022-GilinskyEtAl-LWR.pdf; 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 Victor Gilinsky *et al.*, *A Fresh Examination of the Proliferation Dangers of Light Water Reactors*, Washington, DC: The Nonproliferation Policy Education Center, 2004.

8. On the proper reading of the NPT, see Eldon V.C. Greenberg, "NPT and Plutonium: Application of NPT Prohibitions to 'Civilian' Nuclear Equipment, Technology and Materials Associated with Reprocessing and Plutonium Use," Washington, DC: Nuclear Control Institute, 1984 (Revised May 1993); Paul Lettow, "Fatal Flaw? The NPT and the Problem of Enrichment and Reprocessing," unpublished essay, April 27, 2005; Henry D. Sokolski, "Clarifying and Enforcing the Nuclear Rules," prepared testimony before Weapons of Mass Destruction: Current Nuclear Proliferation Challenges, a hearing before the Committee on Government Reform's Subcommittee on National Security, Emerging Threats, and International Relations, U.S. House of Representatives, September 6, 2006 p. 3, fn. 2, available from www.npec-web.org/files/20060921-FINAL-Sokolski-TestimonyHouseSubcommittee.pdf; and Robert Zarate, "The NPT, IAEA Safeguards and Peaceful Nuclear Energy: An Inalienable Right But Precisely to What?" an essay presented to *Assessing the Ability of the IAEA to Safeguard Peaceful Nuclear Energy*, a conference held in Paris, France, and hosted by the French Ministry of Foreign Affairs, the *Fondation pour la Recherche Stratégique*, and NPEC, November 11-12, 2006, available from www.npec-web.org/files/20070301-Zarate-NPT-IAEA-PeacefulNuclear.pdf.

9. See *The Energy Challenge: Energy Review Report 2006*, London, UK: British Department of Trade and Industry, July 11, 2006, available from www.dti.gov.uk/energy/review/.

10. More on the current membership and investment and trade principles of the Energy Charter Treaty is available from

www.encharter.org/. The second principle of the Global Energy Charter for Sustainable Development calls for:

The establishment of guidelines and internationally standardized methods of evaluation for determining the external effects and total lifecycle costs and risks for all energy systems, taking into account the environmental, health and other damage caused by energy-related activities.

See *The Global Energy Charter for Sustainable Development*, available from *www.cmdc.net/echarter.html*.