Reducing proliferation risks through nuclear energy assistance to developing countries

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As more developing countries consider the use of nuclear technology to produce electricity, educational assistance programs are under way to help minimize proliferation risks.

GROWING NUMBERS OF developing countries are seriously considering the use of nuclear energy to provide baseload electricity production[1] and, in some cases, seawater desalination.[2] Given the strong correlation between the availability of affordable electricity and improved living standards, and the widely voiced concerns about the effects of fossil fuels on the environment, this rising interest in civil nuclear power is understandable and appropriate.

Associated with this growing interest are the legitimate concerns of the international community that this expansion of nuclear energy occur safely while also minimizing proliferation risks. These concerns are not new. The inherent conflict between peaceful and nonpeaceful uses of nuclear technology was recognized with the discovery of sustained nuclear fission in 1938 and was significantly elevated by the nuclear events of 1945 during World War II.[3]

The secret of the atomic bomb is scientific in nature and thus cannot be safeguarded indefinitely. It is feasible, however, to restrict access to the special nuclear materials required for an atomic explosive and to the engineering technology needed to produce these materials. Accordingly, the world community's current approach to nonproliferation emphasizes denying access to sensitive materials and technology.

Although these "supply-side" nonproliferation policies have been generally successful and need to be continued and strengthened, we contend that greater attention should be paid to what might be called "demand-side" approaches to nonproliferation. These approaches are designed to better connect developing countries to the international nuclear energy community and to instill a culture of safety and nonproliferation in the indigenous personnel who will manage a nation's nuclear resources. A properly designed demand-side approach can assist a nation in building its human capacity for implementing and regulating nuclear power in such a way as to reduce proliferation risk.

The developing countries that so far have expressed an interest in nuclear energy vary greatly in size, population, and economic development. They also vary in their political commitment to investing in the infrastructure required for sustainable nuclear energy.[4] For example, a number of countries, such as Bahrain, have merely expressed an interest in nuclear energy, while others, such as the United Arab Emirates (UAE), have actually initiated substantial investment in nuclear power plants.

A major shortcoming of many developing countries, however, is that they often do not possess adequate human resources with the education, knowledge, and experience needed to make informed decisions about whether or when to acquire nuclear power facilities. Moreover, they also lack the indigenous human infrastructure needed to safely and securely build, operate, and regulate nuclear power plants. We believe that engaging these countries by offering demand-side educational assistance during the early stages of their nuclear energy programs can significantly reduce the risk of proliferation.

Cooperation and education

The above-noted human resource gap that exists in developing countries has motivated a number of responses by the governments of nuclear energy–capable countries, many of which, usually in collaboration with their commercial nuclear power industries, universities, and other nongovernmental organizations, offer developing countries a wide variety of nuclear energy–related technical and educational assistance. For example, the authors are currently participating in such a cooperative effort involving U.S. government agencies, universities, and industry groups in the UAE to establish the Gulf Nuclear Energy Infrastructure Institute (GNEII),[5] an educational institute designed to instill global standards for safety, security, and safeguards in the regional personnel who will fill administrative and technical decision-making positions involving nuclear power in Middle Eastern countries.

The establishment of the GNEII is one small part of a larger strategic education program that the UAE is pursuing in cooperation with various nuclear energy–capable nations and the International Atomic Energy Agency. The objective is to build an indigenous human infrastructure that can responsibly regulate and operate the four nuclear power plants that the UAE is purchasing from South Korea.

Similarly, many other developing countries are working to establish cooperative relationships with nuclear energy–capable nations and the IAEA, seeking their assistance with education and training to build their human capacity to support peaceful nuclear energy programs. These educational assistance efforts cover the gamut of science, engineering, and related policy instruction appropriate to peaceful applications of nuclear energy. The goal is to enable a developing country to acquire a cadre of knowledgeable nuclear energy professionals and to develop the institutional capacity to continue educating more of them.

Some might think that this assistance with human capacity building—while aimed at enabling the peaceful use of nuclear energy—actually increases the risk of nuclear proliferation. The concern is that nuclear energy–related educational assistance to developing countries provides at least part of the human infrastructure necessary

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for a given country to develop its own nuclear weapons, thereby increasing the potential for proliferation to occur. We believe that this notion is mistaken, because it neglects important factors regarding the content of the educational assistance provided, the relationship of nuclear power to nuclear weapons, and important aspects of the nature of the global nuclear security environment. All three of these factors act to mitigate and actually reduce the potential for proliferation. That is, rather than increasing the risk of proliferation, demand-side nuclear energy educational assistance programs, when properly designed and administered, tend to reduce proliferation risk.

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Consider first the content of the educational and training courses being offered in the various nuclear energy assistance programs. Does this content add to proliferation risk by educating scientists, engineers, and technicians who will now be better prepared to work on nuclear weapons programs? We acknowledge that an individual who completes a course that expands his or her understanding of, say, nuclear fission is now marginally closer to being a useful member of a nuclear weapon development team than before the course was taken. While this point is self-evident, it is essentially inconsequential, because although the nuclear energy educational assistance being provided to a developing country may in some cases be at the level of graduate courses and degrees, the content of these courses is the same as that found in graduate physics or nuclear engineering programs in major research universities the world over. Students from developing countries enrolled in nuclear energy educational assistance programs learn nothing to help them with nuclear weapons development that they wouldn't have learned if they had attended (as many do) universities in various nations throughout Europe, Asia, or North America.

The same argument applies to assistance with nuclear energy technical training courses that focus on the operation and maintenance of nuclear power facilities. These courses are available the world over and are offered to any interested party. In fact, the nuclear energy assistance courses are merely a variation of what has been occurring for decades as students from third-world countries have enrolled in nuclear and other engineering programs in developed countries since the 1950s. Therefore, at a minimum, based on their content, nuclear energy assistance courses provided to developing countries do not increase the risk of proliferation, because the same educational information is already widely available from universities and other entities.

A second factor disassociating nuclear energy educational assistance programs from increased proliferation risk is the demonstrable lack of connection between peaceful nuclear energy programs and nuclear weapons. The intent of the Nuclear Non-Proliferation Treaty (NPT) is to limit the spread of nuclear weapons. Every country in the world now participates in the NPT, with the exception of India, Pakistan, and Israel, which never signed the treaty, and North Korea, which withdrew from the treaty in 2003. Each of the five NPT-recognized nuclear weapon states (China, France, the Russian Federation, the United Kingdom, and the United States) acquired nuclear weapons *before* developing their peaceful nuclear energy programs. North Korea also obtained its weapons before beginning a peaceful nuclear energy program. The skills, materials, knowledge base, and most of the facilities needed to generate a nuclear arsenal are significantly different from what is needed for a peaceful nuclear electricity production capability. Moreover, establishing and maintaining a nuclear arsenal is an extraordinarily expensive and difficult endeavor. As a result, history shows that when a nation makes the significant decision to develop nuclear weapons, it takes a direct path to that goal. It does not "slide into" a nuclear arsenal by way of a peaceful nuclear energy program.

Who gets assistance?

Nuclear energy assistance programs achieve further separation from the proliferation issue because the assistance goes only to developing countries that are signatories to the NPT and are in good standing with their treaty obligations. In exchange for nuclear energy assistance, developing countries seeking nuclear energy within the NPT's boundaries must accept stringent international inspection and transparency regimes. This step often includes a commitment to refrain from exercising their right to enrich uranium or reprocess used nuclear fuel. Unlike the electricity production function of a nuclear power reactor, the enrichment and reprocessing elements of the nuclear fuel cycle, which can produce fissile material usable in nuclear weapons, actually possess direct proliferation potential.

Accordingly, the courses and training offered in nuclear energy educational assistance programs focus mainly on the electricity-production element of the fuel cycle—the nuclear power reactor. Other than a general description of enrichment and reprocessing activities required as background for teaching the critically important topics of nuclear security and safeguards, nuclear energy assistance programs do not serve to enhance the student's scientific or engineering understanding of enrichment or reprocessing technologies.

In many of the developing countries that are currently assessing the potential of nuclear power, familiarity with nuclear matters in general is limited to a tiny fraction of the populace. For instance, in a given developing country, only a few people may have experience using or regulating medical sources or radioisotopes for industrial use. In these circumstances, the general public is often ill-informed about and distrustful of terms such as "nuclear security" and "nuclear safeguards" when used in discussions about implementing nuclear energy. A common belief is that these are code words for roadblocks that the nuclear energy–capable nations employ to inhibit a developing country's progress toward nuclear energy. Moreover, it is often the case that few people in these countries, including public officials, thoroughly understand or are even familiar with the NPT. As a result, one early objective of nuclear energy educational assistance programs is to establish in the developing country a core group of knowledgeable government officials who are conversant in all aspects of nuclear energy matters. Until a nation's decision-makers acquire a factual understanding of the international obligations and responsibilities required of nations employing nuclear energy, little useful progress can be made in evaluating whether, when, or how to implement nuclear power in a given developing country.

In light of these considerations, nuclear energy educational assistance programs should be designed to establish a "global culture" that reflects the critical importance of nuclear safety, security, and safeguards. An effort should be made to embed this important cultural message in as many of the instructional activities as possible, including lectures, projects, exercises, labs, field trips, simulations, and research.

Also, to the extent possible, the nuclear energy assistance curriculum should include opportunities for students to interact directly with their professional counterparts in the IAEA and with nuclear energy specialists in other countries. These interactions encourage the development of personal and professional relationships, developing the students into members of a global community of fellow professionals on whom they can call for assistance and advice and with whom they will continue to expand their professional knowledge base.

In short, a properly designed nuclear energy educational assistance program will establish a modern and self-sustaining nuclear safety and security culture in the developing country as it seeks to implement its peaceful nuclear energy strategy. This cultural component of nuclear energy assistance programs may be the enterprise's most significant and long-lasting contribution to reducing the risk of proliferation.

Implementing nuclear energy educational assistance programs for developing countries can also contribute to the global nuclear security environment by enhancing the credibility and standing of the NPT. Article IV of the NPT encourages nuclear energy–capable states to aid non-weapon states with peaceful nuclear energy.[6] When the United States complies with Article IV by offering appropriately designed nuclear energy educational assistance programs, it constructively promotes broader compliance with the treaty, fundamentally reducing proliferation risk.

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Finally, it must be recognized that any NPT-compliant nation-state that is evaluating nuclear energy as a source of electricity to improve its citizens' standard of living has a moral right to do so. If the United States refuses to assist such a nation with its nuclear aspirations, some other country will certainly step in to take its place. A clear illustration of this dilemma was the U.S. government's effort in the 1970s to stop the spread of nuclear fuel reprocessing technology around the world by closing down U.S. reprocessing research and associated international cooperative programs. This approach did not stop the spread of reprocessing technology. Instead, it pushed the United States out of its valuable technological leadership role and inarguably contributed to the cost and delay of finding a solution to its nuclear waste problems. This is not an outcome we want to repeat.

The nonproliferation policies of the United States will be much better served if it actively participates in the educational processes needed to build knowledgeable human capital in developing nations seeking to use nuclear energy. Maintaining vigilance on the supply side by preventing access to key materials and technology is still important, but working on the demand side to help developing nations reap the substantial benefits of nuclear energy offers a powerful means for making significant and long-lasting reductions to the risks of nuclear proliferation.

Endnotes

1. *Report on Proliferation Implications of the Global Expansion of Civil Nuclear Power,* U.S. Department of State (Apr. 7, 2008). <www.nuclear.gov/pdfFiles/rpt_ISAB_GlobalExpansionofCivilNuclearPower_Apr2008.pdf>
2. *IAEA Activities in Assisting Developing Countries to Implement Agenda 21: A Review (1993–2001),* Background Paper No. 6. <www.un.org/jsummit/html/documents/backgrounddocs/iaea%20report.pdf>
3. *Report on the International Control of Atomic Energy* (the *Acheson-Lilienthal Report*), prepared by a committee cochaired by Dean Acheson and David Lilienthal, Washington, D.C. (March 16, 1946).
4. *Emerging Nuclear Energy States,* Pregnezer and Bonin, Internal Report, Sandia National Laboratories (May 15, 2008). The nuclear events of 1945 led to a series of in-depth policy studies aimed at creating an international framework to control the destructive power of the atom. One of the main insights from these studies was that the apparent secrets of the atomic bomb were scientific in nature, and thus could not be monopolized forever. This point is supported by a number of examples (e.g., Pakistan) where a motivated country has developed nuclear weapons or the capability to build one.
5. D. Boyle, A. Mohagheghi, A. Williams, "GNEII—Instilling Global Standards for Nuclear Safety, Security, and Safeguards in Developing Countries," *Proceedings of the INMM 51st Annual Meeting,* Baltimore, Md. (July 11–15, 2010).
6. Article IV excerpt: "Parties to the Treaty in a position to do so shall also cooperate in contributing . . . to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapons States Party to the Treaty, with due consideration for the needs of the developing areas of the world." NN