**Addressing Nuclear Terrorism:**

Today's frightening instability in Pakistan comes in a world in which global terrorists are actively seeking nuclear weapons and the materials and expertise needed to make them, a quest that has been underway for more than a decade. Rapid action is needed to keep the Taliban's advances in Pakistan from creating new opportunities for these deadly adversaries.

Yet, assessing nuclear security in Pakistan should not be viewed in isolation. The challenges faced by Pakistani authorities must be seen in their broader context to be properly understood and effectively countered. All countries in possession of nuclear weapons are concerned about the possibility of losing control over a bomb or weapons-related material. Consequently, states must pay utmost attention to securing these means of mass destruction. Recent years have seen increased international cooperation on nuclear security, improvements in international material protection control and accounting procedures, and increased funding for nuclear security-related initiatives. Despite increases in the scope and sophistication of security measures, much work remains to be done to lock down all nuclear materials to a Fort Knox standard. The fact remains that missing weapons-usable material turns up regularly on the nuclear black market. The most worrisome aspect of these recurring incidents is that facilities from which the materials originated did not report them missing. In addition, there have been some notable lapses in warhead security, even in the United States.

Ensuring complete control over nuclear equipment, material, and technology is more difficult now than at any time in the past. There is a burgeoning global interest in all things nuclear. More states are seeking nuclear technologies, power, and weapons. Production, transportation, and storage of nuclear materials will expand throughout the 21st century. The presence of more material in more places increases the odds of a security breach leading to the loss of a bomb or the theft of materials to make a bomb. The anticipated global renaissance in nuclear energy will pose new challenges in this regard unless the associated proliferation risks are fully considered in decisions on materials processing, transportation, and storage. In this light, it is essential to secure not only weapons-grade plutonium and uranium from military programs, but also plutonium, highly enriched uranium, and other materials from civilian programs. Materials that would not meet the standards required for a nuclear weapon developed by a state might be usable in a terrorist's yield-producing bomb.

Thus, a zero-tolerance standard must be adopted for the loss of any nuclear weapon or of materials that may be fashioned into a bomb. Terrorists know that they can exploit any vulnerability to their advantage. In December 1998, Osama bin Laden expressed al Qaeda's intent when he stated in an interview, "Acquiring weapons [of mass destruction] for the defense of Muslims is a religious duty." In November 2001, he added, "I wish to declare that if America used chemical or nuclear weapons against us, then we may retort with chemical or nuclear weapons. We have the weapons as deterrent."

The greatest threat of a loose nuke scenario stems from insiders in the nuclear establishment working with outsiders, people seeking a bomb or material to make a bomb. Nowhere in the world is this threat greater than in Pakistan. Pakistani authorities have a dismal track record in thwarting insider threats. For example, the network run by the father of the Pakistani bomb, Abdul Qadeer Khan, channeled sensitive nuclear technologies to Iran, Libya, and North Korea for years under the noses of the establishment before it was taken down in 2003, to the best of our knowledge. The Umma-Tameer-e-Nau (UTN), founded by Pakistani nuclear scientists with close ties to al Qaeda and the Taliban, was headed by Sultan Bashiruddin Mahmood, who had overseen Pakistan's Khushab reactor. He discussed al Qaeda's nuclear aspirations with bin Laden. Per Mahmood, bin Laden asked him how he could construct a bomb if the group already had the material. It is stunning to consider that two of the founding fathers of Pakistan's weapons program embarked independently on clandestine efforts to organize networks to sell their country's most precious secrets for profit.

Pakistani authorities certainly recognize the gravity of this problem. One of the ways they are coping is to emphasize secrecy and clandestinely over the more visible manifestations of nuclear security. The U.S. and Russian model of nuclear security relies on redundant layers of high walls, gates, and guards at sites to produce a highly visible image of impenetrability that will deter those seeking to gain access to them. Essentially, Pakistan has sacrificed some of the advantages of the traditional approach to security in favor of reducing unique vulnerabilities and threats arising from the circumstances in which it finds itself.

The thrust of the Pakistani military's strategy is to reduce its vulnerability to a nuclear security incident by systematically denying outsiders opportunities to gain illicit access to nuclear weapons. Consequently, the nuclear establishment is distributed geographically: Materials processing and weapons production facilities are consolidated in sites near Islamabad in areas under tight government control. Special nuclear material is reportedly stored apart from the weapons themselves. Warheads are reportedly stored separately from delivery systems.

Another precaution taken by the Pakistani military is to maintain strict secrecy over the location of storage sites and to transport and deploy weapons clandestinely rather than in convoys that have a stronger, highly visible security profile. These security precautions produce fewer visible signs of movements, thereby lowering the risks associated with possible theft of or attack on weapons at their most vulnerable point, in transit.

Fortunately, it appears that the odds of such a security breakdown are very low, at least from an assessment based on the current realities of the security situation in Pakistan. The authorities appear to be serious about countering Taliban advances in the country. That is vital because ensuring continued stability and law and order is the most important factor in averting the possibility of a nuclear catastrophe.

**Nuclear Energy as an Alternate Source of Energy:**

The drive for civil nuclear power has resurged around the globe, often under the banner of finding a clean energy alternative to meet growth objectives. Countries like India, Saudi Arabia, United Arab Emirates (UAE), Turkey, Egypt, and Jordan, among others, have all proclaimed a desire for nuclear power generation. Proponents argue that nuclear energy promotes economic development and reduces reliance on foreign sources of energy in a manner that is climate change friendly due to the lack of carbon emissions. Similarly, Pakistan has pushed for nuclear power generation using many of the same arguments. Advocates for this initiative have underscored the recent congressional approval of the U.S.-India Civil Nuclear Cooperation agreement, which provides India with access to nuclear equipment and components from Western suppliers. As Pakistan’s Prime Minister Yousaf Raza Gilani stated: “Now Pakistan also has the right to demand a civilian nuclear agreement with America. We want there to be no discrimination. Pakistan will also strive for a nuclear deal, and we think they must accommodate us.”1 A critical question, 104 however, is whether nuclear power is necessary and vital to economic development in a climate-change friendly manner.

This analysis looks at the economic and resource arguments for nuclear power through 2030 to evaluate whether nuclear power is necessary to meet Pakistan’s energy expectations. First, the analysis evaluates the assertion that nuclear energy is vital to meet economic development goals. Second, this chapter analyzes the claim that global carbon emissions will be reduced by such an amount as to make salient the argument for increased Pakistani nuclear power generation capability. Finally, it evaluates whether development of nuclear energy would significantly reduce Pakistan’s reliance on foreign energy sources. The framework used to evaluate resource options for electricity development (see Figure 1) includes looking at the total potential capacity, the likely pace of development of different technologies, the relative costs of those options, and the environmental issues and trade-offs inherent with each option.

Pakistan’s current electricity generation capacity also does not meet the current demand, creating significant shortfalls. The country is presently experiencing supply deficits during peak demand periods and the variability of water supply contributes to deficits given the large reliance on hydropower.3 Nearly half of the population is also estimated to lack connection to the electricity grid, and load shedding has also become necessary in some areas.4 Some estimates suggest that the grid system requires approximately 107 two additional GW to cover peak demand with an adequate degree of reliability.

Compounding the challenges for meeting current demand, Pakistan’s generation capacity requirements are expected to increase significantly through 2030 (see Figure 3). Forecasts for this growth rate vary and are generally tied to gross domestic product (GDP) expansion, which represents the energy intensity of economic growth. The Government of Pakistan estimates are based on an 8 percent GDP growth rate and a corresponding 9 percent generation capacity growth rate, thereby requiring 163 GW of generation capacity by 2030. However, the historical generation capacity growth rate from 1980-2005 was roughly 7.1 percent, and, if this trend continues, the capacity by 2030 would likely be 108 GSs. The actual generation capacity developed by 2030 will likely be somewhere in between these two ranges. However, even assuming a stronger GDP growth rate of 8.5 percent, thereby exceeding the Government of Pakistan projections, the need would be roughly 193 GSs. While the energy intensity varies, and tends to decrease as an economy develops, the estimates of generation capacity present a conservative range against which to test the need for specific supply options. Considering the recent global financial and economic downturn, Pakistan’s GDP growth rate could be significantly constrained, which could also create a concurrent reduction in the need for generation capacity.

**Measures to Implement and Enforce the Nuclear Program in Iran**

Nuclear weapons proliferation, whether by state or no state actors, poses one of the greatest threats to international security today. Iran's [apparent](http://www.cfr.org/iran/implementation-npt-safeguards-agreement-islamic-republic-iran-february-2012/p27467) efforts to acquire nuclear weapons, what amounts to North Korean nuclear blackmail, and the revelation of the A.Q. Khan black market nuclear network all underscore the far-from-remote possibility that a terrorist group or a so-called rogue state will acquire weapons of mass destruction or materials for a dirty bomb.

The problem of nuclear proliferation is global, and any effective response must also be multilateral. Nine states (China, France, India, Israel, North Korea, Pakistan, Russia, the United Kingdom, and the United States) [are known](http://www.iaea.org/Publications/Magazines/Bulletin/Bull492/49204734548.html) or believed to have nuclear weapons, and more than thirty others (including Japan, Germany, and South Korea) have the technological ability to quickly acquire them. Amid volatile energy costs, the accompanying push to expand nuclear energy, growing concerns about the environmental impact of fossil fuels, and the continued diffusion of scientific and technical knowledge, access to dual-use technologies seems destined to grow.

The [Nuclear Non-proliferation Treaty](http://www.cfr.org/publication/8437/) (NPT) is the core component of the global non-proliferation regime, and establishes a comprehensive, legally binding framework based on three principles: (1) states without nuclear weapons as of 1967—a year before the treaty opened for signature—agree not to acquire them; (2) the five states known to have tested nuclear weapons as of 1967—the nuclear weapon states (NWS)—agree to not assist other states in acquiring them and to move toward eventual disarmament; and (3) the non-nuclear weapons states (NNWS) are guaranteed access to civilian nuclear technology and energy development.

NNWS are subject to safeguards to ensure that materials and technology from civilian activities are not diverted to weapons programs. The [International Atomic Energy Agency](http://www.iaea.org/) (IAEA) is the implementing body for the NPT, monitoring compliance with the treaty and assisting NNWS in developing civilian technology. Although the scope and mandate of the NPT and the IAEA are relatively broad, there is a critical gap in coverage: 189 states are party to the treaty, but three of the world's nine nuclear powers—India, Israel, and Pakistan—have never joined, and a fourth—North Korea—withdrew in 2003. Thus, even if enforcement of the existing regime were not an issue, nearly half of the world's nuclear-armed states are excluded from its provisions.

In late 2011, the importance of securing nuclear material came into focus again following the collapse of Muammar al-Qaddafi's regime in Libya. In September 2011, ten thousand drums of uranium yellowcake were discovered in a Libyan warehouse, [virtually unguarded](http://www.telegraph.co.uk/news/worldnews/africaandindianocean/libya/8787721/Dumped-in-the-desert-...-Gaddafis-yellowcake-stockpile.html), although a UN official [claimed](http://www.cbsnews.com/stories/2011/09/26/501364/main20111540.shtml) the material was only "slightly" radioactive and did not pose an immediate threat.

The Obama administration brought additional attention to this issue, pledging to secure all vulnerable nuclear weapons materials by 2014 and convening a high-level global nuclear security summits in 2010 and 2012. The 2010 summit yielded tangible results, with Ukraine announcing that it would get rid of all its Soviet-era highly enriched uranium, and five other countries stating intentions to convert their research reactors to run on low-enriched uranium, which is less dangerous. The next global nuclear security summit is planned for 2014 and will take place in the Netherlands.

A related concern, ranging from pioneering nuclear powers like the United States to more recent powers like Pakistan, is the security of nuclear arsenals, specifically regarding safeguarding warheads from accidents, theft, or unauthorized use. The [security](http://www.theatlantic.com/magazine/archive/2011/10/the-ally-from-hell/8730/) of Pakistan's arsenal is a serious concern, especially for the United States. Reports have emerged that nuclear warheads are often transported on normal roads with little to no protection. While Pakistan has always countered that its arsenal is secure, some U.S. officials have voiced concern about the possibility of one of Pakistan's weapons falling into the hands of terrorists.

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