

An Environmentally-Conscious Approach to Meeting Energy Demands: US-India Collaboration in the Global Nuclear Energy Renaissance

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Energy-related carbon dioxide (CO₂) emissions are expected to increase by more than fifty percent over the next twenty years¹.

Given the positive correlation that has been identified between increased commercial CO₂ emissions and increased near-surface global temperatures,^{i,ii} strong international demand has emerged to reduce industrial CO₂ emissions. As a nuclear scientist with a background in nuclear energy and weapons policy, my participation in the China-India-US Science, Technology and Innovation Policy Workshop was motivated by the pronounced global need for environmentally responsible energy production. Nuclear power holds such a promise – It does not require the burning of fossil fuels and thus does not produce carbon dioxide or other harmful greenhouse gases. Currently, only 3 percent of India's and 2.3 percent of China's electricity generation are derived from nuclear power, compared with 20 percent for the United States.^{iii,iv} In order for China and India, whose energy use is expected to double by 2030,^v to sustain adequate power generation without the overproduction of greenhouse gases, the global expansion of nuclear power is essential.

Given the sudden and significant increase in power generation by coal in recent years, coal-fired power generation represented a key focus of the Bangalore Workshop. Using historical reference data^{vi} and assuming static laws and policies, China accounts for 71 percent of the abrupt increase in world coal consumption, while the United States and India each account for 9 percent.^{vii} In 2005, coal consumption in these three countries constituted over 60% of the world's total coal utilization.^{viii} Yet, several recent studies suggest that lifecycle greenhouse gas emissions resulting from coal-fired energy generation are dramatically greater than that arising from nuclear energy generation.^{ix,x} In an investigation by AEA Technology, the total CO₂ emissions resulting from electricity generated at the UK Torness nuclear power station, calculated on a lifecycle basis, were estimated to be just over 5 grams per kilowatt-hr [g/kWh]; This is in comparison with CO₂ emissions from a typical coal-fired power plant, based solely upon the operational stage, of 900 g/kWh.^{xi} Although clean coal technologies can mitigate the negative environmental effects of coal-fired power generation, as highlighted in the workshop, many clean coal technologies are expensive to implement and not readily available in India and China. Despite environmental concerns, direct access to low-cost coal reserves in China, India and the United States make coal-fired energy generation an unfortunate, but economically attractive alternative to nuclear power.

The vitality of the nuclear energy renaissance is contingent, in part, on international fiscal collaboration to offset high capital costs, technological cooperation to implement the

required redundant safety systems, containment buildings and other safety-related nuclear equipment as well as innovations in international policy governing the civilian nuclear industry. My journey to Bangalore, India and participation in the China-India-US Science, Technology & Innovation Policy Workshop provided me with a unique opportunity to explore political barriers to the US-India 123 Agreement – a bilateral deal that holds the promise of enhanced technological and economic collaboration in the area of civilian nuclear power generation.^{xii} The Agreement allows for the transfer of nuclear material and information to India, including Indian access to the international nuclear fuel market, and gives India reprocessing rights for spent fuel, ultimately placing her on level with other leading countries possessing advanced nuclear technology.^{xiii} In order for the nuclear deal to be implemented, approval is required from the United States Congress, as well as the International Atomic Energy Association (IAEA) and the Nuclear Suppliers Group (NSG).^{xiv} This agreement paves the way for India's reduced dependence on coal by fostering US-India collaboration in the use of nuclear energy for peaceful purposes.^{xv}

Throughout the China-India-US Science, Technology and Innovation Policy Workshop, the pursuit of environmentally responsible strategies for meeting global energy demands remained central to the discussion. Although nuclear energy did not represent one of the three main case studies of the workshop, the vital role of nuclear power generation in addressing global energy challenges was formally acknowledged. In the Workshop's inaugural address, the Honorable Union Minister for Science, Technology and Earth Sciences in the Government of India, Shri Kapil Sibal, spoke favorably of the US-India 123 Agreement, citing it as a pathway for India to enhance Indo-US relations and to initiate fruitful international collaborations in the generation of civil nuclear energy, as well as in other areas of advanced technology. Dr. Sonika Gupta, Professor in the Department of Humanities and Social Science at the Indian Institute of Technology in Madras expressed support for the bilateral nuclear deal, claiming that it created opportunities for India in the civil nuclear energy sector while allowing India to maintain its nuclear weapons program – an issue important to India's sovereignty and national security vis-à-vis Pakistan.^{xvi} The workshop also provided a venue for an informal sampling of the perspectives of the Indian populace on the US-India 123 Agreement. Following Session I of the Workshop, a local television crew interviewed Dr. Norman Neureiter, Co-Director of the Indo-US Science and Technology Forum and Director of the Center for Science, Technology & Security Policy at the American Association for the Advancement of Science. The crew passionately challenged Neureiter's support of the Indo-US civil nuclear collaboration, expressing concerns that the bilateral nuclear deal would undermine India's right to test nuclear weapons.

Despite concerns by Indian citizens that the United States might delay or even cease essential nuclear fuel supplies should India resume nuclear testing, the IAEA has approved an "India-specific" safeguards agreement, which guarantees indefinite nuclear fuel supplies in exchange for India's maintenance of IAEA safeguards, methods for verifying that nuclear material or technology is not used for nuclear weapons purposes, on all nuclear material and equipment transferred or produced under the Agreement.^{xvii} Although the US-India 123 Agreement does not recognize India as a Nuclear Weapon State, defined by the Nuclear Nonproliferation Treaty (NPT) as a state "which has

manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967,” an additional, *de facto* category was created in July 2005 when President Bush referred to India as a “responsible state with nuclear weapons technology.”^{xxviii} Being that India is the first non-Nuclear Weapon State to be extended a unique IAEA safeguards agreement, Pakistani opponents, among others, have protested India’s “special treatment” as discriminatory.^{xxix} However, India, the second most populous country in the world, is in a unique position given its projected dramatic increase in energy consumption and global environmental concerns. India is not perceived as a threat to the greater international community and the indigenous development of its nuclear weapons capabilities and tight export controls demonstrate its proven track record in nuclear nonproliferation.^{xxx} The “India-specific” IAEA agreement ensures that nuclear safeguards are upheld over Indian civilian nuclear reactors and ushers India into regular IAEA surveillance, a triumph for the nonproliferation regime.

On September 6, 2008, the US-India 123 Agreement was granted approval by the Nuclear Suppliers Group; an assembly of forty-five nations whose role it is to support non-proliferation efforts through nuclear material, equipment and technology export controls. The NSG granted a nuclear waiver to India, making an exception on a ban that previously prohibited trade to non-NPT signatories, and thereby allowing international commerce for India in peaceful nuclear components and technology. The decision was released after India committed to uphold a voluntary moratorium on nuclear weapons testing.^{xxxi} However, Anil Kakodkar, Chairman of the Atomic Energy Commission, reported that nuclear fuel supplies would not immediately cease upon India’s test of a nuclear device. Kakodkar claimed, “There will be sufficient opportunity for us to explain why we had to test. On our part, we have to make sufficient arrangements to ensure uninterrupted functioning of our reactors before we decide on an atomic test.”^{xxxii} Given the possibility of a rapid and weighty shift in India’s national security climate, it is important for the Indian government to retain independence of foreign policy. However, in practice, India is not currently conducting tests and the country recognizes that further nuclear weapons tests will sour India’s international standing and destabilize the nonproliferation regime.

Despite the willingness of professionals and Indian government officials to adopt a more environmentally conscious energy policy, Indian support for US-India civil nuclear energy collaboration has not been unchallenged. Although formal approval from the Parliament of India is not required for approval of the US-India 123 Agreement, in July 2008, the Singh government introduced a parliamentary vote of confidence, which was supported, clearing a path for the nuclear deal.^{xxxiii} Nonetheless, the bilateral deal has faced strong internal opposition. Indian Left parties have voiced concerns that the “alliance entails not just nuclear cooperation but talks of the two countries promoting global democracy.”^{xxxiv} Some suggest that the US-India collaboration would incite a galvanized Pakistani-China alliance, destabilizing the South Asian region.^{xxxv} The agreement has also faced opposition from the scientific community in India. Indian nuclear physicists and engineers have long explored thorium-based nuclear reactor systems, which exploit India’s abundant indigenous thorium resources. Discord arises from concerns that India will become reliant on international fuel supplies and/or be

forced into US-championed nonproliferation programs.^{xxvi} Additional apprehensiveness exists among some members of the Indian populace that India will be coerced into a moratorium on fissile material production.^{xxvii} Notwithstanding the divergence of views, it is widely recognized that India's ability to attain the requisite power generation capacity to sustain its economic growth is dependent upon the expansion of its civil nuclear energy program.^{xxviii} The extraordinary technological and economic benefits to the US-India 123 Agreement eclipse the current political barriers of such a course of action.

Recent reports from the Chinese government indicate disdain for the US-India 123 Agreement, with China claiming that Indo-US collaboration sets a "double standard" within the nonproliferation regime and establishes a precedent for other bilateral nuclear pacts.^{xxix} Despite media reports from Vienna of strong Chinese opposition to the NSG's India-specific waiver, a spokesperson for the Chinese Foreign Ministry reiterated China's support of the entitlement of all countries to nuclear energy for peaceful purposes.^{xxx} Nonetheless, given that China is currently the lone Asian nuclear weapon state recognized by the Non-Proliferation Treaty,^{xxxi} the US-India 123 Agreement may be viewed as a threat to China's nuclear preeminence in South Asia. Although it has been alleged that "by strengthening relations with China's next-door neighbor, the [Bush] administration saw the potential for a strategic hedge"^{xxxii} to counter the Chinese-Pakistani nuclear alliance, United States government officials maintain that the US-India 123 Agreement will strengthen the nonproliferation regime by bringing India under IAEA safeguards, while providing a politically acceptable and environmentally conscious pathway to address India's burgeoning energy demand. The importance of environmentally responsible energy generation, global energy security and the role of nuclear energy systems were recognized by both India and the People's Republic of China in a November 2006 joint declaration. It is important for India and China, as well as the United States, to present a unified front in the nuclear nonproliferation regime, in addition to a commitment to clean and sustainable energy systems for the benefit of future generations. By outlining the technological, economic and political criteria for a suitable US-India nuclear energy partnership, the barriers to environmentally responsible global energy generation can be successfully navigated.

The final hurdle for enactment of the US-India 123 Agreement is approval by the United States Congress. Since passage of the 2006 Hyde Act – United States law delineating a series of requirements for US-India nuclear collaboration – strong and opposing views among congressional members have been presented in many political debates on the deal. Vice presidential candidate and Democratic Senator Joseph Biden pledged to "push like the devil" to expedite the passage of the US-India 123 Agreement,^{xxxiii} while Democratic Representative Howard Berman is expected to desire additional hearings before allowing a vote on the nuclear deal.^{xxxiv} Although Senator Joe Lieberman expressed confidence that the United States Congress would approve the pact,^{xxxv} the 2006 Hyde Act requires Congress to be in 30 days of continuous session before a decision on the US-India 123 Agreement is made. The 2008 Congressional session has scheduled a recess for September 26th and as a result, the vote may be put to a new Congress presiding under a new administration in early 2009. However, given that the NSG has already granted a

waiver to India, there is strong financial incentive for the United States to pass the legislation before other countries engage India in international nuclear trade.^{xxxvi}

The global nuclear renaissance has been met with consternation, with opponents citing the widespread dissemination of nuclear material and technology as a threat to the nuclear nonproliferation regime.^{xxxvii} Dual-use technologies become of paramount importance as the availability of nuclear material increases and the basic knowledge of nuclear weapons fabrication spreads. However, the risks of the expansion of nuclear power must be weighed against the benefits of this powerful technology, not only to offset excessive CO₂ emissions, but also to assuage the effect of skyrocketing oil and gas prices, particularly in developing countries. The energy crisis is in the forefront of the international arena and nuclear power provides a channel for massive energy generation without the overproduction of ozone-depleting greenhouse gases. The challenge remains to foster the expansion of nuclear energy while maintaining stringent safeguards, thereby preventing nations who choose to adopt nuclear energy systems from transferring sensitive nuclear material, equipment or technology. It must be demonstrated that a US-India strategic nuclear energy partnership be established – in such a way that the current non-proliferation regime is not undermined – with energy security, decreased environmental impact and uncompromised state security and sovereignty of paramount concern. Given the dire environmental concerns resulting from increased greenhouse gas emissions and the escalating global energy demand, the world must find a way to embrace the global expansion of nuclear power while mitigating the nuclear proliferation risks.

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