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NUCLEAR FUEL BANKS:

MOSCOW, WASHINGTON TO LEAD ON "MERGERS"

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EXECUTIVE SUMMARY

The United States and Russia are still the giants of nuclear power, accounting for more than half the world's enriched uranium production. Twenty-five percent of the world's nuclear power plants are found in the United States and half of those power plants use Russian uranium. Russian nuclear fuel now constitutes 10 percent of the U.S. power generation mix. The interdependence arising from existing trade in nuclear fuel points toward a natural partnership.

The two countries, however, have been unable to capitalize as well as they might on this potential at the bilateral level or in important multilateral forums. Both the United States and Russia would benefit from demonstrating stronger joint leadership to promote civil nuclear energy frameworks on two levels: domestically, to satisfy rising power demand and to align foreign investment regimes; and internationally, to restrain nuclear proliferators and/or contain rising insecurity about proliferation threats. Aside from the benefits for energy security, bilateral cooperation in this field could also rejuvenate stalled United States-Russia dialogue on other matters of global strategic importance.

This potential for an effective political framework for cooperation will remain unrealized until and unless both governments step up and make concrete commitments to move this promising agenda forward beyond current plans.

The civil nuclear dossier has often been held hostage to serious divergences between Moscow and Washington over larger global strategic issues, including Iran. There are profound differences in opinion between Russian and U.S. (and Western) security experts and elites as to the range of cooperative possibilities in the nuclear energy relationship. The delay in ratifying the United States-Russia Civil Nuclear Cooperation Agreement by the Senate has been one of the most recent policy developments that reinforce this perception of almost insurmountable differences. The delay overshadows the points on which the two countries have a commonality of interest and see eye to eye. On the U.S. side, one of the major concerns is the lack of openness of Russian nuclear industry to foreign investment and competition.

But there is reason for optimism as the stage is already set for closer cooperation between the United States and Russia. A proliferation-resistant, closed fuel-cycle solution for civil nuclear energy is a point on which both countries can agree. Add in complementary expertise in nuclear power generation and you have an ideal match. The United States and Russia should build on these foundations by promoting technical cooperation between

their respective civil nuclear industries that would significantly advance national energy security and bring tangible commercial benefits.

The United States and Russia share a vision of a sustainable energy future less reliant on dwindling and environmentally damaging fossil fuels. A joint U.S.-Russian initiative on civil nuclear energy would be a step closer to this goal. Such a partnership could also help to close the door on past rivalry between these two major powers while simultaneously promoting global security. Given the likely benefits of cooperation that would accrue to both states, it would be careless to let past suspicions overcome prudence.

Key recommendations to the Governments of Russia and the United States

- Commit to a firm date such as 31 June 2009 for making a joint proposal on an international fuel bank that effectively merges the separate proposals of each (U.S. Global Nuclear Energy Partnership and Russian Fuel Bank Initiative), while incorporating the most promising elements of other related proposals from countries like Germany and Japan.

- Create a bilateral inter-governmental commission to map concrete technical parameters for civil nuclear cooperation and to smooth over potential non-nuclear obstacles.

- Put in place a firm framework for transfer to developing countries of affordable and proliferation-resistant technology through a multilateral nuclear technology knowledge bank based on public-private cooperation under the auspices of the International Atomic Energy Agency.

- Use the knowledge bank to develop a set of political and business incentives that promote a clear and rapid move to new power generation solutions, such as thermo-nuclear fusion.

- De-couple bilateral civil nuclear cooperation from U.S.-Russian negotiations on Iran and third party non-proliferation issues.

INTRODUCTION: A COMMONALITY OF INTERESTS

There is a clear commonality of interests between the United States and Russian nuclear industries. Despite the clear interest expressed by both sides since at least 1991 for greater cooperation in this field, civil nuclear power generation remains an underdeveloped area in bilateral relations. There is an urgent need to define the parameters for this bilateral cooperation and to outline the potential obstacles that must be overcome.

The shared goal of non-proliferation represents a fundamental point of agreement between the United States and Russia. After the July 2007 Bush-Putin summit, the White House issued a statement underlining the fact that both countries are "determined to play an active role in making the advantages of the peaceful use of nuclear energy available to a wide range of interested states, in particular, developing countries, provided the common goal of prevention of proliferation of nuclear weapons is achieved."[1] The statement also outlined legal, political, and technical mechanisms to be used to fulfill this pledge, including "a range of modern, safe, and more proliferation-resistant nuclear power reactors and research reactors appropriate to meet the varying energy needs of developing and developed countries." The statement included a promise to develop new solutions for the management of spent nuclear fuel and the storage and reprocessing of radioactive waste.[2]

During the April 6 2008 Sochi Meeting between George W. Bush and Vladimir Putin, they signed a 'Strategic Framework Declaration' called for a joint US-Russia leadership to support" new approaches focused on environmentally-friendly technologies that will support economic growth, promote the expansion of nuclear energy, and create a viable alternative to the spread of sensitive nuclear fuel cycle technologies".[3] The Declaration expressed support for Russia's International Uranium Enrichment Center in Angarsk and the U.S. Global Nuclear Energy Partnership (GNEP) "aimed at accelerating the development and deployment of advanced fuel cycle technologies", which "would substantially reduce nuclear waste, simplify its disposition, and draw down existing inventories of civilian spent fuel in a safe, secure and proliferation resistant manner."[4] Both countries also supported the International Atomic Energy Agency's (IAEA) "Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) that has brought together both the states with developed nuclear technology and states running small-scale nuclear

[1] Office of the Press Secretary, "Declaration on Nuclear Energy and Nonproliferation: Joint Actions," the White House, July 3, 2007, http://www.whitehouse.gov/news/releases/2007/07/20070703.html.
[2] Ibid.
[3] U.S.-Russia Strategic Framework Declaration, Press Release, Office of the Press Secretary, the White House, April 6, 2008 http://www.whitehouse.gov/news/releases/2008/04/20080406-4.html
[4] Ibid.

programs or just developing plans for peaceful use of nuclear energy" and committed themselves to "creating reliable access to nuclear fuel" under the IAEA auspices".[5]

The major challenge for Washington and Moscow will be to work "in a sufficiently quick and flexible manner" and "come together and have a common vision and really start looking not only at the near term, but also in the future."[6] The development of civil nuclear technology is, however, bigger than just the United States and Russia. The U.S. special envoy for nuclear nonproliferation, Robert Joseph, noted that the joint U.S.-Russian initiative would include "other suppliers as well as many potential beneficiaries. More than a dozen countries...have expressed interest in acquiring nuclear reactors. Now is the time to help shape their decisions in a way that advances our common interest."[7]

Despite some commercial disagreements, there is common ground for bilateral and multilateral cooperation. For example, in respect of non-proliferation, both Moscow and Washington want to keep in place the "carrot and stick" approach of the Nuclear Non-Proliferation Treaty (NPT) and do not favor any further expansion of the global nuclear club. In terms of concrete cooperative nuclear energy projects between Russia and the United States, there are already several on the ground that can be used as a launch-pad for more. In eastern Siberia, Russia is laying the groundwork for an international fuel bank with the creation of the Angarsk International Enrichment Center, which will contribute to nonproliferation objectives by providing a reliable supply of nuclear fuel. The United States is preparing 17.4 metric tons of Highly Enriched Uranium (HEU)—now in the process of down-blending—to support the Russian fuel bank initiative. Such cooperation should help to secure cost-competitive, sustainable, and reliable global fuel supplies and services. A secure fuel supply would help countries considering nuclear power to feel sufficiently energy secure to rely on existing U.S. and Russian proposals rather than pursuing their own enrichment and reprocessing schemes.

U.S. and Russian proposals have a similar rationale—to limit access to the enrichment process and, therefore, reduce the risk of WMD proliferation, while

[5] Ibid.
[6] U.S. Department of Energy official, EWI interview.
[7] Robert G. Joseph, "Briefing With U.S. Special Envoy for Nuclear Nonproliferation Robert G. Joseph and Russian Federation Deputy Foreign Minister Sergei Kislyak on Cooperation in Nuclear Energy and Nuclear Nonproliferation," State Department, July 3, 2007, http://www.state.gov/r/pa/prs/ps/2007/87659.htm.

keeping open the 'civil nuclear door' to negotiate fair conditions with both producers and consumers.

U.S.-Russian leadership in this field could also be expanded to include countries that already have access to the full nuclear fuel cycle (for example, France and Japan). The political and economic weight of other major players adhering to any bilateral United States-Russia initiatives would reinforce existing initiatives (e.g. Proliferation Security Initiative, Fissile Material Cut-Off Treaty, Nuclear Threat Initiative, etc.), re-establish confidence in cooperative international civil nuclear energy regimes, and help stimulate movement towards a universal nuclear energy framework.

The proposed course of action by Russia and the United States would be completely in line with the recommendations of the Commission of Eminent Persons on the future of the IAEA, published in May 2008 especially in relation to "four strong partnerships ... needed to forge a reinvigorated nuclear order: first, between nuclear weapons states and non-nuclear weapon states; second, among nuclear technology and fuel-cycle suppliers, states that want nuclear energy, and the IAEA; third, among the states, the private sector, and international agencies; and fourth, among developed countries, developing countries, international development institutions and the IAEA."[8]

The non-proliferation of nuclear weapons plays an extremely important role in U.S.-Russian relations, but this should not be the only major pillar for bilateral cooperation. The bilateral high-level negotiations that produced the civil nuclear energy plan (the so-called Bodman-Kiriyenko action plan) submitted to Presidents Bush and Putin on December 15, 2006, and the signing of the 123 Agreement in Moscow[9] showed that relations may be evolving. In addition, recent changes in Russia's position on sanctions against Iran may help facilitate congressional ratification of the 123 Agreement. This is a start but it is incumbent upon Moscow and Washington to continue to look for further points of mutual interest and understanding in the area of civil nuclear energy.

[8] "Reinforcing the Global Nuclear Order for Peace and Prosperity: The Role of the IAEA to 2020 and Beyond", Commission's of Eminent Persons Report, Vienna, May 2008, p. 8. See http://belfercenter.ksg.harvard.edu/files/gov2008-22gc52inf-4.pdf.

[9] Agreement between the Government of the United States of America and the Government of the Russian Federation for Cooperation in the Field of Peaceful Uses of Nuclear Energy (also known as the 123 Agreement).

COMPLEMENTARY EXPERTISE

Functional cooperation between the U.S. and Russian scientific, engineering, and business communities holds the promise of serving as a basis for higher-level political interaction. There is an opportunity to find common points of agreement and overcome narrow parochial interests to "create a wedge, which can open the diplomatic space."[10] A new situation that focuses on a commercial and technological approach could restore the productive bilateral relations of the mid-1990s, when the United States and Russia "were really in the throes of a cooperative assistance posture."[11] Complementary technological expertise could prove to be the catalyst for a stronger political partnership between the two governments.

An effective joint proposal on civil nuclear energy would require a full spectrum of nuclear capabilities and knowledge. Russia has exclusive knowledge and vast experience in the building of small and middle scale nuclear power reactors, especially those used in nuclear submarines and icebreakers. The U.S. nuclear industry dominates the world's market for large-scale and low-waste fast neutron reactors. It also possesses unique technological expertise, particularly in the field of computer simulation. The addition of U.S. investment, together with its political and scientific support, would facilitate the joint commercial use of U.S. and Russian nuclear technologies.

CIVIL NUCLEAR ENERGY AS THE FUTURE

The increasing importance of nuclear energy in the global energy mix is considered by many to be a given. The International Atomic Energy Agency (IAEA) estimates that, by 2020, nuclear energy use will increase globally by 22 to 44 percent. The increased share of nuclear energy in the global energy balance is directly linked to broader concerns over the availability, security, and environmental consequences of fossil fuels. Within the context of climate change, nuclear energy is being touted by a growing number of politicians, including Presidents Bush and Putin, as a critical, low-emission energy source. At the same time, the Organization for Economic Co-operation and Development (OECD) countries, as well as China and India, are confronting serious issues with regards to the security of fossil fuel supplies, access to these resources, and the availability of new oil and gas fields. Nuclear energy has, in light of these concerns, and because of its proven potential and

[10] Comment by a representative of U.S. administration (under Chatham House rules).

[11] Ibid.

relatively low cost, become increasingly attractive as an alternative to fossil fuels.

The Economist noted that the "latest boost to nuclear has come from climate change. Nuclear power offers the possibility of large quantities of baseload electricity that is cleaner than coal, more secure than gas and more reliable than wind. And if cars switch from oil to electricity, the demand for power generated from carbon-free sources will increase still further."[12] Indeed, many of the developed world's governments are "concerned that most of the world's oil and gas is in the hands of hostile or shaky governments," while "much of the…uranium, by contrast, is conveniently located in friendly places such as Australia and Canada."[13]

This concern over fossil fuels is driving many countries back into the arms of nuclear power. The United States currently operates 104 nuclear reactors, more than any other country, and one industry spokesperson has estimated that 30 new reactors will be built in the United States within the next 15 to 20 years.[14] On average, four reactors have come to life every year since 1996. Currently, there are at least 27 nuclear reactors under construction—18 in Asia, five in Europe, one in Iran, and a total of three in North and South America. Worldwide, there are 443 nuclear power generation reactors.

The reactors, however, are distributed unevenly, with 90 percent of all capacity located in OECD countries and the former states of the Soviet Union, where nuclear reactors account for 22.4 and 17 percent, respectively, of the electricity produced there. The remaining 10 percent of world nuclear power generation capacity is located in China, India, and other "energy hungry" developing countries, where nuclear energy represents only 2.1 percent of their national electricity mix on average.

Nuclear power generators are expensive to build but very cheap to run. [15] By contrast, the increasing cost of natural gas and coal, which represents the most important primary energy source for power generation, may well upgrade the profitability and investment attraction of nuclear power. It is estimated that the average cost of nuclear energy in the United States is about 1.7-1.8 cents per kilowatt-hour (kWh), while the average price for non-nuclear electricity reached 5 cents/kWh in 2005. In most of United States as well as in the

[12] "Nuclear power's new age," *The Economist*, September 8, 2007, 11.
[13] Ibid.
[14] Andrew E. Kramer, "Russia's nuclear power company finds business is good - in Iran and elsewhere," *International Herald Tribune*, June 7, 2007.
[15] For example, the most recent plant built in the United States (Watts Bar in Tennessee) cost US $6.9 billion.

European Union, the price of electricity is "closely linked to the price of natural gas, since gas-fired plants…provide the extra power required at times of peak demand."[16]

Nuclear power if used safely and with precautions can provide solutions to the major global energy security challenges: it reduces CO2 emissions, provides cheap electricity and, therefore, is able to address rising demand in fast growing and populous countries. It also partially addresses the fears of energy dependency as most of the world's uranium supplies are located in politically stable regimes.

THE 'DISPOSAL' ISSUE

Disposal is a highly controversial issue both from an environmental and non-proliferation point of view, and it is at the center of an intense international debate. There are currently two main options for dealing with nuclear waste:

I) Dispose of nuclear waste in deep, isolated geological formations for the several thousand years that it may remain dangerous.

II) Reprocess the spent fuel in order to separate the remaining low quantities of plutonium from U-238 for use in new fuel. Produced plutonium is mixed with uranium to make mixed-oxide fuel (MOX).

The commercial use of weapons-grade plutonium (used both in reactors and in nuclear weapons) represents a significant challenge for the existing international non-proliferation regime. MOX fuel has played an important role in the U.S.-Russian agreement on the disposal of weapons-grade plutonium. The agreement aims to reprocess 34 metric tons of U.S. and Russian plutonium from dismantled nuclear warheads into normal nuclear fuel for commercial power generation. In 2007, Moscow and Washington agreed to dispose two metric tons of plutonium per year.[17]

In executing the Plutonium Disposition program, special attention was paid to the Material Protection Control and Accounting (MPC&A) program, which is aimed at protecting nuclear weapons, weapon-grade nuclear materials, and other radiological sources.

[16] "Atomic renaissance," *The Economist*, September 8, 2007, 67.
[17] Elena Sokova, "Plutonium Disposition," NTI Issue Brief (Nuclear Threat Initiative, July 2002), http://www.nti.org/e_research/e3_11a.html.

Both the Russian Fuel Bank Initiative and the U.S. Global Nuclear Energy Partnership (GNEP) include plans to deal with spent nuclear fuel, making it re-usable in power stations, thereby reducing the disposal issue.

HISTORY OF COOPERATION

Both countries have been seeking a formal, civil nuclear cooperation agreement since 1991. The Nunn-Lugar Cooperative Threat Reduction Program (CTR) represented a highpoint in bilateral cooperation on nuclear disarmament. However, relations became tense after 1995 due to concerns over Russian nuclear cooperation with Iran, which Washington claimed could contribute to Tehran's capacity to develop nuclear weapons. The U.S. administration was strongly opposed to Russian involvement in the construction of the Bushehr power station and at one point even introduced sanctions against Russian research institutions and companies involved in nuclear and conventional military cooperation with Iran.

U.S. and Russian positions began to converge, however, when President Putin put forward an initiative in January 2006 aimed at creating a network of international enrichment centers to provide full nuclear cycle services. Putin proposed to transform the former military facilities in Angarsk (eastern Siberia) into a pilot enrichment center under the auspices of the IAEA. Following Iran's rejection of the Russian offer, Moscow voted in February 2006 to support the U.S.-backed proposal to signal to the United Nations (UN) Security Council Iran's breach of the NPT.[18] As a result, Washington became more constructive in accepting Russian engagement with the Iranian nuclear program.

The White House has been more open than the U.S. Congress with regard to formalizing a Moscow-Washington partnership. On May 6, 2008, in Moscow, the U.S. ambassador to Russia, William Burns, and the director of RosAtom, Sergey Kiriyenko, signed a 123 Agreement for peaceful nuclear energy cooperation. This agreement, providing for the commercial sale of civil nuclear commodities (including export of nuclear fuel and repatriation of spent fuel), will facilitate the importing and storage of spent fuel as part of the IUEC initiative. It will also "enhance U.S.-Russia cooperation in developing Global Nuclear Energy Partnership (GNEP) technologies, in particular the development of advanced fast burner reactors, the fuel for which would likely

[18] Gaukhar Mukhatzhanova, "U.S.-Russian Civilian Nuclear Cooperation Agreement," NTI Issue Brief (Nuclear Threat Initiative, July 2006), http://www.nti.org/e_research/e3_78.html.

be developed in the United States and transferred to Russia for test irradiation."[19]

The 123 Agreement quickly faced opposition on Capitol Hill, where two senators threatened to block the deal, which they saw as hurting efforts to freeze Iran's nuclear weapons program.[20] But the administration, according to one report, "views Russia as a partner in the effort to persuade Iran to abandon nuclear weapons ambitions. A State Department official said the United States did not view Russia's assistance to Iran's Bushehr nuclear power plant as a reason to not sign the new deal."[21]

Russia and the United States have a long, sometimes troubled, but in large part successful cooperation on nuclear energy matters, as programs like Megatons to Megawatts, the MPC&A Program, and the Nunn-Lugar Cooperative Threat Reduction Program demonstrate. Moreover, they have largely complementary areas of expertise that would help to create the next generation of nuclear reactors, deal with decommissioning and waste management problems, and move towards promising fusion-based reactors (both within the ITER initiative and independently). Both Moscow and Washington share a strong mutual interest in preventing WMD proliferation. Concern over nuclear proliferation was the main rationale behind the U.S. GNEP initiative and Russia's Fuel Bank Initiative.

Nunn-Lugar Cooperative Threat Reduction Program

Moscow and Washington's history of non-arms control nuclear cooperation across a broad range of areas since 1991 lies mostly in the framework of the $9 billion worth Nunn-Lugar Cooperative Threat Reduction Program. The CTR program aims to reduce proliferation risks by dismantling and protecting weapons of mass destruction (WMD) and associated infrastructure in states of the former Soviet Union (FSU). This initiative served as a platform for later initiatives such as the "Megatons to Megawatts" program, moving cooperation away from a purely security domain to a partially commercial framework. The program remains active and has since expanded to include a focus on the trafficking of WMD and the improvement of border and maritime security in the FSU.

[19] Bureau of European and Eurasian Affairs, "U.S.-Russia Agreement for Peaceful Nuclear Cooperation (123 Agreement)," fact sheet, State Department, May 15, 2008, http://www.state.gov/p/eur/rls/fs/104917.htm.
[20] Frederic J. Frommer, "US-Russia pact faces opposition in Congress," *Associated Press*, May 6, 2008, http://ap.google.com/article/ALeqM5g10Dfkn5cFOwVj86C7vc23AsAkGAD90GE7UG0.
[21] Ibid.

The Nunn-Lugar Program covers:

- non-proliferation of nuclear weapons, including the protection of radioactive materials;
- reduction of the nuclear weapons infrastructure and the quantities of weapons-grade nuclear materials;
- protection and safety of nuclear civil and military nuclear facilities;
- developing technical capacities to detect WMD and radioactive materials.

The Nunn-Lugar program has contributed to significant reductions in nuclear arms. As of February 2007, the United States and Russia "have jointly deactivated and destroyed: 6,312 nuclear warheads; 537 Intercontinental ballistic missiles (ICBMs); 459 ICBM silos, and 708 nuclear air-to-surface missiles."[22]

"Megatons to Megawatts"

The $12 billion, 20-year HEU program (Megatons to Megawatts), signed by the U.S. and Russian governments on February 18, 1993, was designed to create a legal framework for selling around 1500 metric tons of low-enriched uranium (LEU) fuel to U.S. power stations. The LEU would be derived from 500 tons of weapons-grade highly enriched uranium (HEU) from dismantled Russian nuclear warheads and nuclear submarine reactors. However, the HEU program cannot begin until the United States-Russia 123 Agreement is ratified.[23]

Both Moscow and Washington created government-owned corporations to act as the deal's executors. The United States set up the United States Enrichment Corporation (USEC), while the Russian Federation created Tekhsnabeksport (TENEX). According to the agreement, the diluted uranium is shipped by TENEX to the United States, acting on behalf of Russian Ministry for Atomic Energy (MinAtom)—now the Russian Atomic Energy Agency, or RosAtom—where USEC then sells it as fuel for nuclear power generation. There is a complex commercial agreement whereby USEC is free

[22] Embassy of the United States in Russia, "Bicentennial Partnership: Nuclear Cooperation," http://us-russia200.moscow.usembassy.gov/200th/anniversary.php?record_id=security.

[23] A "123 Agreement" refers to Section 123 of the U.S. Atomic Energy Act of 1954. This Act defined the criteria that must be included in U.S. agreements for nuclear cooperation with other states. (See the National Nuclear Security Administration website: http://nnsa.energy.gov/nuclear_nonproliferation/123_agreements_peaceful_cooperation.htm.)

to resell the enrichment component (adhering the federal and international law) and TENEX retains title to—and thus the right to resell—the feed component.[24]

The energy value of the Megatons to Megawatts contract, according to the USEC, is equal to 6 trillion kilowatt or 60 trillion cubic feet of gas, 3 billion tons of coal, or 10 billion barrels of oil.[25] Moreover, the LEU (30 tons per year) generates half of U.S. nuclear energy and supplies up to 10 percent of U.S. electricity consumption. In 2006, Russia exported 5,800 tons of LEU to the United States, which represented almost 50 percent of total U.S. imports of low-enriched uranium.

Challenges to the Megatons to Megawatts deal

On April 26, 1996, President Clinton signed the USEC Privatization Act, which established the annual amount of natural uranium that could be imported for sale within the United States. This bill created a number of misunderstandings over the implementation of the Megatons to Megawatts contract and use of pricing mechanisms. At that time, due to the then low uranium prices, the contract was overly generous to Russia and the U.S. administration could not force the newly privatized USEC to accept higher-than-market nuclear fuel prices. The situation became more complicated in 1998, when USEC management openly questioned whether they should stay a part of this deal. In 1998-1999, both sides reached an agreement ("HEU Feed Deal") that partly resolved the issue of price (linking it to market price with up to 15 percent discount) and commercial sale of LEU stockpiles. In addition to this agreement, TENEX signed a Commercial Feed Agreement with private companies to purchase most of the feed component refused by USEC. On June 16, 2007, both parties amended the existing agreement to ensure that there is sufficient natural uranium in Russia to blend down the HEU to commercially usable LEU through the remaining term of the Megatons to Megawatts program.

However, the recent rapid rise in global commodities and uranium prices and the interest of Russian nuclear fuel producers in fuel sales in the United States—the world's biggest nuclear power generation market—may force some changes. Currently, many Russian experts believe that the existing

[24] Center for Defense Information, "Megatons to Megawatts: The U.S.-Russia Highly Enriched Uranium Agreement," May 14, 2004, http://www.cdi.org/friendlyversion/printversion.cfm?DocumentID=2210.

[25] See "World Security 'Significantly Enhanced' by USEC and TENEX," USEC Inc. News Release, http://www.usec.com/newsroom/newsreleases/usecinc/2003/2003-04-13-world-security-significantly-enhanced.htm.

Megatons to Megawatts deal damages the commercial interests of the national nuclear industry. Russian fuel producers are currently only able to get around $90 per kilo of LEU uranium fuel, while the market price reached $140 per kilo and is predicted to continue to increase through 2015 due to the current imbalance between supply and demand in the World uranium market. Mikhail Stiskin of Russia's leading investment bank 'Troika Dialog' estimates that Russia's share in U.S. nuclear imports will finally stabilize around 33 percent, while TENEX's spokeswoman Ekaterina Shugaeva hopes that the new agreement will stimulate U.S. investment in the Russian civil nuclear sector. This policy is in line with a statement made by then Russian president Vladimir Putin in Munich on February 10, 2007: "In the energy sector Russia intends to create uniform market principles and transparent conditions for all. It is obvious that energy prices must be determined by the market instead of being the subject of political speculation, economic pressure or blackmail."[26]

TOWARD FUNCTIONAL COOPERATION

The Bodman-Kiriyenko Plan and United States-Russia 123 Agreement

During his visit to the United States in May 2006, RosAtom head Sergei Kiriyenko agreed with Department of Energy secretary Samuel Bodman (his U.S. counterpart) to start formal negotiations on a bilateral civil nuclear cooperation agreement. Later, on July 15, 2006, during the G8 summit in St. Petersburg, Presidents George Bush and Vladimir Putin announced that the United States and Russia would be starting negotiations shortly. The G8 summit's final document on global energy security took note of "recent potentially complementary initiatives put forward in the IAEA framework regarding multilateral fuel supply assurances, as well as the proposals made by Russia and the United States aimed at further development of peaceful nuclear energy, in a manner that promotes proliferation resistance of the nuclear fuel cycle, including preventing the spread of sensitive nuclear technologies."[27] The G8 announcement was eventually formalized in the Bodman-Kiriyenko Plan.

This bilateral plan was signed in December 2006 and led to the May 2008 signing of a 123 Agreement between the United States and Russia. The Bodman-Kiriyenko plan aimed to provide a framework for bilateral cooperation

[26] Transcript available at: http://www.kremlin.ru/eng/speeches/2007/02/10/0138_type82912type82914type82917type84779_118123.shtml.

[27] Group of Eight, "Global Energy Security," G8 Saint Petersburg Summit Declaration, July 16, 2006, http://en.g8russia.ru/docs/11.html.

in the development of nuclear energy technology and deployment of nuclear facilities. "This agreement between our two nations will help further nuclear technology, but also the path to more securely expand the use of nuclear energy around the world," said Secretary Bodman.[28] The Bodman-Kiriyenko Plan was likely intended to be an action plan for cooperation in the area of civil nuclear energy in the absence of a ratified 123 Agreement between Washington and Moscow.

The document described the major strategic goals of bilateral cooperation and outlined in detail the most promising areas of cooperation, putting a special emphasis on the expansion of safe and emission-free nuclear power. The report stressed ways to find a "common vision for the structure of the global nuclear energy system of the future, and for discouraging the spread of sensitive nuclear fuel cycle technologies through comprehensive nuclear fuel services"[29] as well as proposing new solutions for waste management. The Kiriyenko-Bodman plan outlined U.S. and Russian strategies for nuclear power generation, and established a "common basis for U.S.-Russian cooperation in advanced recycling reactors, exportable small and medium reactors, nuclear fuel cycle technologies, and nonproliferation."[30]

The U.S. Department of Energy and Russia's Rosatom would concentrate cooperation efforts on the development of export-oriented models of small and medium nuclear reactors (traditionally Russia's stronghold), the use of fast-neutron reactors, and development of new fuel for traditional and fast power reactors as well as implementing advanced methods for the recycling of nuclear waste, fuel cycle services, and nonproliferation safeguards. The agenda is managed by a working group, which includes representatives from:

- U.S. Department of Energy
- National Nuclear Security Administration (United States)
- U.S. Department of State
- leading national laboratories in the United States.
- RosAtom
- Russian Federal Service for Ecological, Technical, and Atomic Supervision (Rostekhnadzor)
- Russian Ministry of Foreign Affairs

[28] U.S. Department of Energy, 'U.S. and Russia Develop Action Plan to Enhance Global and Bilateral Nuclear Energy Cooperation,' Press Release, December 19, 2006, http://www.ne.doe.gov/newsroom/2006PRs/nePR121906.html.

[29] Ibid.

[30] Senate Committee on Energy and Natural Resources, *Statement of Dennis R. Spurgeon Assistant Secretary for Nuclear Energy*, 110th Cong., 1st Sess., November 14, 2007, http://www.congressional.energy.gov/documents/November_14_-_NE-Spurgeon.pdf.

- Russian Ministry of Defense
- Fuel Cycle Initiative (Russia)

The working group is co-chaired by U.S. Department of Energy Assistant Secretary for Nuclear Energy Dennis Spurgeon and the RosAtom Deputy Director Nikolay Spasskiy.

Both the United States and Russia hoped that the agreement would advance both the U.S. GNEP initiative and the Russian Fuel Bank Initiative by combining their strengths and sharing their responsibilities.

U.S. Global Nuclear Energy Partnership

The Global Nuclear Energy Partnership (GNEP), proposed by U.S. energy secretary Samuel Bodman in February 2006, mirrors similar initiatives of the Russian Federation in its aim to promote the "global use of nuclear energy, while limiting its potential to contribute to proliferation."[31] GNEP is based on the development and dispersal of proliferation-resistant nuclear energy technologies, including "advanced 'burner' reactors, which would utilize spent nuclear fuel from traditional reactors. This would reduce the amount of plutonium remaining in spent reactor fuel and, it is hoped, not only reduce proliferation risks but also the amount of radioactive waste needing long-term management."[32] GNEP would benefit from U.S.-Russian civil nuclear cooperation and opens the possibility of storing spent nuclear fuel in Russia. In July 2001, President Putin signed three bills adopted by the State Duma that favored the import of spent nuclear fuel to Russia. However, in December 2006, Sergey Kiriyenko of RosAtom stated that foreign spent nuclear fuel should not be imported as there is still no available reprocessing technology. "We mainly import Russian spent nuclear fuel," said Kiriyenko.[33]

Washington needs Russia's world-class industrial enrichment capacities. Currently, the United States has only one commercial uranium enrichment capacity unit (in Kentucky), and has not yet started the construction of new facilities. Under GNEP initiatives, it is planned that states that do not currently possess full cycle enrichment facilities will be offered the possibility of receiving nuclear fuel for power stations and send back spent fuel to the enrichment/reprocessing facilities located in countries with access to the full nuclear cycle such as the United States, Russia, Japan, and France.

[31] Mukhatzhanova, "U.S.-Russian Civilian Nuclear Cooperation Agreement."
[32] Ibid.
[33] Bellona, "Russia should not import foreign nuclear fuel for storage and reprocessing," December 8, 2006, http://www.bellona.org/news/news_2006/onlyrussnf.

Some speculate that Russia could use the issue of spent nuclear fuel as a tool to exert political pressure to gain more favorable conditions for Russia in the forthcoming negotiations and to make peace with Russian environmental groups and others who fear a nuclear renaissance.[34]

Angarsk and the Fuel Bank Initiative

In 2006, President Vladimir Putin proposed setting up an international system of uranium-enrichment centers to discourage proliferation while making nuclear energy for peaceful purposes available to all. The Angarsk project is part of Russia's Fuel Bank Initiative to prevent nuclear proliferation by creating a system of enrichment centers under the supervision of the IAEA. Nuclear fuel would be provided by a Russian-Kazakh uranium enrichment reprocessing center or other leasing arrangements. The plant will also process nuclear waste for disposal. The Angarsk center has a capacity of 2 million separative work units (SWU), enough to produce electricity to satisfy the demands of a city populated by 12 million inhabitants for an entire year. China, emerging as a major civil nuclear power, has a capacity of only one million SWU/year (while Russia possesses 20 million SWU/year capacity), which cannot match China's domestic demand for nuclear fuel, thus making China a potentially attractive market for Angarsk's nuclear fuel.

According to Russian nuclear expert Anton Khlopkov, "the establishment of the International Uranium Enrichment Centre (IUEC) in Angarsk will be important but just the first step in the implementation of multilateral approaches towards nuclear fuel cycle solutions."[35] Where there is nuclear fuel, the issue of spent nuclear fuel will arise and Khlopkov argues there is only one option: to initiate the creation of a center for handling spent fuel along with the enrichment center, thus creating a full-cycle facility (enrichment-fuel production-reprocessing of the spent fuel).[36]

There are already potential clients for Angarsk Enrichment Center, including Japan and other Asian countries with a growing nuclear energy sector. Moreover, none of the Middle East countries planning to develop nuclear energy, including Iran, possess capacity for nuclear fuel manufacturing on the industrial level.[37]

[34] Ibid.
[35] Anton Khlopkov, "Pervogo Shaga Malo" [First step is not enough], *World Energy 42, no.6 (*June 2007), http://pircenter.org/data/publications/nextstep.pdf.
[36] Ibid.
[37] Ibid.

The IUEC benefits from easy access to uranium ore. Kazakhstan and Uzbekistan, Central Asia's and world's two major uranium producers, are attracted by the geographic proximity of Angarsk and its potential commercial conditions. Moreover, the Russian government has guaranteed that all bona fide consumers would have unrestricted access to the enrichment center in Angarsk. The Russian ambassador to the United Nations, Vitaly Churkin, recently confirmed that the enrichment center, jointly established by Russia and Kazakhstan, will be open to third countries without any political preconditions. Commercial conditions, access to uranium ore, and a ready-made market make the Russian initiative both commercially attractive and politically acceptable to the new nuclear fuel clients.

CIVIL NUCLEAR ENERGY AND THE NON-PROLIFERATION TREATY

Civil nuclear energy is directly linked to the dual use technology problem enshrined in U.S. export control legislation: enrichment and reprocessing cycles use technological tools similar to those used in military class centrifuges. Thus, the spread of civil nuclear technologies, if left unmanaged, could facilitate access to military technologies and enriched weapons-grade radioactive materials. The NPT, initially created to stop the proliferation of military nuclear technologies, had a clear "carrot and stick" mechanism. Article IV.1 states that "Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty."[38] Article IV.2 more specifically addresses the concerns of developing countries, claiming that "all the Parties to the Treaty undertake to facilitate, and have the right to participate in…. exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy. Parties to the Treaty in a position to do so shall also cooperate in contributing alone or together with other States or international organizations to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world."[39] However, the NPT treaty was not accepted universally and did not prevent Israel, India, Pakistan, and, later, North Korea, from developing military nuclear capabilities.

[38] International Atomic Energy Agency, *Treaty on the Non-proliferation of Nuclear Weapons*, INFCIRC/140, April 22, 1970, http://www.iaea.org/Publications/Documents/Infcircs/Others/infcirc140.pdf.
[39] Ibid.

Initially created to halt proliferation, the NPT has now become compromised. Arguably, the United States is undermining the NPT by concluding a nuclear deal with India, thus creating a valid pretext for Iran (and other countries) to misuse the NPT provisions to undermine the current non-proliferation regime.[40]

Many countries—both developing and developed—are afraid of being cut off from energy supplies (whether fossil fuel-based or uranium-based) and are extremely concerned about the potential for misuse of nuclear energy—as a weapon and as a foreign policy tool. These concerns present Moscow and Washington with an opportunity to come up with a constructive joint initiative on the peaceful use of nuclear energy and put their weight and authority behind new initiatives at the international level, engaging all nuclear states and giving all bone fide energy consumers fair access to nuclear energy.

A U.S. and Russia-backed intergovernmental "knowledge bank" based on the joint private-public sector initiatives may be an appropriate answer to proliferation concerns and rising global demand for the nuclear energy. This proposal can be backed by recent decision of Russian authorities voiced by Deputy Prime Minister Sergei Ivanov to open Russia's nuclear sector to foreign investment.

This knowledge bank would make available proliferation-resistant nuclear technologies such as small-scale floatable reactors and nuclear energy services for state and private entities in the developing world, while compensating developers and patent-holders. The financial burden should be shared between the governments of developed and developing countries, international organizations, and, on a voluntary basis, the private sector.

CONCLUSION

Aside from the multilateral aspects of managing civil nuclear energy regimes, there is a clear strategic importance for the United States and Russia to be far more energetic and results-oriented in bilateral nuclear energy projects. There is also a need to avoid over-politicization of the civil nuclear energy issue. U.S.-Russia cooperation on the civil nuclear issue should be separated from other significant political issues so that disagreement on those points does not impede advancement on the nuclear side. In fact, civil nuclear energy can be

[40] For more details on article IV of the NPT, see Lawrence Scheinman, "Article IV of the NPT: Background, Problems, Some Prospects," commissioned paper (Weapons of Mass Destruction Commission, June 2004), http://www.wmdcommission.org/files/No5.pdf.

for the U.S. and Russia what coal and steel were for post-World War II Germany and France—a tool to foster technical cooperation on a practical, functional, and non-politicized basis in order to overcome past geopolitical rivalry.

In the case of Moscow and Washington, cooperation between their respective atomic industries could be a good foundation for rethinking bilateral relations: Washington and Moscow can finally decide to agree to disagree on a number of fundamental issues in order to focus on functional cooperation, and slowly build up a better general political relationship. On a purely business level, even higher levels of cooperation between interdependent U.S. and Russian civil nuclear industries will bring tangible mutual benefits and strengthen competitive advantages on both sides. These nuclear initiatives may catalyze bilateral cooperation in other areas such as political cooperation, arms control, and trade, and form the basis for strong and stable relations.

Both governments want to avoid unnecessary competition and, at the same time, both are interested in a stable depoliticized global civil nuclear market. Moscow and Washington can and should exercise their influence and authority to convince other countries to join an enhanced international nuclear regime, maintain the stability of a new energy security framework, and persuade other players that the United States and Russia do not aspire to maintain an exclusive hold in the area of nuclear technologies.

Civil nuclear energy cooperation could symbolize a tipping point for U.S.-Russian relations. This opportunity should not be wasted. The U.S. and Russian administrations have a responsibility to demonstrate leadership in encouraging the success of joint nuclear energy initiatives.

Key recommendations to the Governments of Russia and the United States

- Commit to a firm date such as 31 June 2009 for making a joint proposal on an international fuel bank that effectively merges both national proposals (U.S. Global Nuclear Energy Partnership and Russian Fuel Bank Initiative), while incorporating the most promising elements of other related proposals from countries like Germany and Japan.

- Create a bilateral inter-governmental commission to map concrete technical parameters for civil nuclear cooperation and to smooth over potential non-nuclear obstacles.

- Put in place a firm framework for transfer to developing countries of affordable and proliferation-resistant technology through a multilateral nuclear technology knowledge bank based on public-private cooperation under the auspices of the IAEA.

- Use the knowledge bank to develop a set of political and business incentives that promote a clear and rapid move to new power generation solutions, such as thermo-nuclear fusion.

- De-couple bilateral civil nuclear cooperation from U.S.-Russian negotiations on Iran and third party non-proliferation issues.

GLOSSARY OF TERMS

Advanced burner reactors—a type of low-waste fast neutron reactor that produces energy without generating waste that would require permanent, geologic disposal.

Angarsk Project—a uranium enrichment center in eastern Siberia. Part of the Russian "Fuel Bank" initiative aimed at discouraging proliferation and making nuclear energy for peaceful purposes available to all countries.

Bodman-Kiriyenko Plan—a report produced by U.S. energy secretary Samuel Bodman and the head of RosAtom, Sergey Kiriyenko, signed in December 2006 as a part of an energy security agreement adopted during the July 2006 G8 Summit in St. Petersburg. The report describes the major strategic goals of bilateral cooperation and outlines the most promising areas for cooperation with special emphasis on the expansion of emission-free nuclear power.

Fuel Bank Initiative—a Russian program to build a series of international uranium enrichment centers (IUEC) to provide nuclear energy to third parties under the supervision of the IAEA.

Generation IV International Forum—a forum established in 2001 to promote cooperation between leading nuclear technology states in order to develop next generation nuclear energy systems to meet future energy needs.

Global Nuclear Energy Partnership (GNEP)—a U.S. initiative for cooperation on civil nuclear energy that supports the development and spread of proliferation-resistant closed-fuel cycle nuclear energy technologies.

ITER initiative—a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power.

Low-waste fast neutron reactors—reactors that minimize the use of materials (such as water) that slow neutrons, thereby producing more fuel than they consume.

Material Protection Control and Accounting program (MPC&A)—an international cooperative effort to secure and account for nuclear weapons and materials.

Megatons to Megawatts (Highly Enriched Uranium Agreement)—a $12 billion, 20-year program, signed by the U.S. and Russian governments on

February 18, 1993, to create a legal framework for selling around 1500 metric tons of low-enriched uranium (LEU) fuel to U.S. power stations.

Mixed oxide fuel (MOX)—a blend of oxides of plutonium and natural, reprocessed, or depleted uranium. MOX is used as a proliferation-resistant alternative to LEU fuel in light water reactors that dominate the nuclear power generation industry.

Nunn-Lugar Cooperative Threat Reduction (CTR) Program—a $9 billion program set up in 1991 by U.S. senators Sam Nunn and Richard Lugar to assist FSU states with the deactivation and destruction of nuclear weapons.

Separative Work Unit—a measurement used in the nuclear power industry. It takes around 100,000 SWU of enriched uranium to fuel a typical 1,000-megawatt (MW) commercial nuclear reactor for a year.

Tekhsnabeksport (TENEX)—a Russian government-owned corporation established to act as executor for the Megatons to Megawatts deal. Acting on behalf of MinAtom and RosAtom, TENEX is responsible for shipping the diluted uranium to the United States.

United States Enrichment Corporation (USEC)—a U.S. government-owned corporation established to act as executor for the Megatons to Megawatts deal. USEC sells the fuel component of the diluted uranium shipped by TENEX for nuclear power generation in the United States.

Uranium 238 (U-238)—used to breed plutonium-239, which can then be used as a source of reactor fuel.

123 Agreement—A 123 Agreement refers to Section 123 of the U.S. Atomic Energy Act of 1954, which indicates the terms that must be included in U.S. agreements for nuclear cooperation with other states. An Agreement for Cooperation must be established under the criteria outlined in the Atomic Energy Act in order for the U.S. to authorize the transfer of civil nuclear technology to other nations. (National Nuclear Security Administration)

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