

NUCLEAR DANGERS NUCLEAR REALITIES



WORKSHOP REPORT
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**REPORT ON THE WORKSHOP
NUCLEAR DANGERS, NUCLEAR REALITIES**

**Riyadh, Saudi Arabia
April 11-12, 2010**

**Institute of Diplomatic Studies of the Foreign Ministry of Saudi Arabia
King Faisal Center for Research and Islamic Studies, Riyadh
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PREFACE AND ACKNOWLEDGEMENTS

This report summarizes the discussion of a workshop held in Riyadh, Saudi Arabia, in mid-April 2010. The workshop was a collaboration of the Stimson Center in Washington, DC, and the King Faisal Center for Research and Islamic Studies, and the Institute of Diplomatic Studies of the Ministry of Foreign Affairs of Saudi Arabia.

The workshop explored the linkages and the latest developments in two distinct but related issues: the rapid expansion of interest and activity in acquiring nuclear energy, and the enduring global imperative of preventing the proliferation of nuclear technology for weapons and other non-civilian purposes. The goal of the workshop was to bring experts from these two fields together, and to examine trends and future prospects in “nuclear dangers, nuclear realities.”

The workshop was also an opportunity for constructive dialogue between Saudi and American experts on these topics, with important contributions by scholars and practitioners from other Middle Eastern countries, Europe, Russia and Asia. We are grateful to all who participated and shared their wisdom and experience: Arzu Celalifer, Amb. Nabil Fahmy, Sami al-Faraj, Bong-Geun Jun, Yoriko Kawaguchi, Giacomo Luciani, Victor Mizin, Amb. Abdel Raouf El-Reedy, and Bruno Tertrais.

The report was drafted by Stimson President Ellen Laipson, Distinguished Fellow Dr. Barry Blechman, Senior Associate Brian Finlay, and Research Associate Andrew Houk. The draft benefited from useful feedback from Stimson Chairman Amb. Lincoln Bloomfield, Jr., and Stimson trustee Dr. Jean Francois Seznec, both of whom participated in the Riyadh workshop, and from experts at the King Faisal Center. The report captures the main points made at the workshop, and provides additional context and detail on some topics, as well as references to events that occurred after the workshop, such as the Nuclear Nonproliferation Treaty Review Conference, to make its analysis timely and relevant to ongoing discussion on these topics.

INTRODUCTION AND OVERVIEW

In the future, historians may look at 2009 and 2010 as decisive years in the evolution of nuclear energy. If several pressing problems are resolved successfully, these years may be seen as the point at which world leaders set a course that not only made a renaissance in peaceful uses of nuclear energy possible, but also placed the community of nations decisively on the road to eliminating nuclear weapons. If these problems remain unresolved, the period could be seen as the time in which the world lurched toward the widespread proliferation of nuclear weapons and all the dangers that would accompany such a future. We are, in short, at a turning point.

PEACEFUL USES OF NUCLEAR ENERGY

Public attitudes toward nuclear energy have changed markedly over the past ten years. Concerns about the effects of burning hydrocarbons on global climate and the adequacy of petroleum and natural gas reserves for future energy needs, to say nothing of the risks associated with the extraction and transport of hydrocarbon fuels, have spurred renewed efforts to find alternative sources of energy. Although efforts to develop technologies that would make renewable energy sources such as solar and wind power economically competitive have been accelerated, nuclear power has already been providing electricity, medical diagnostics and treatments, and desalination for decades and its technology is already well advanced. As a result, many nations have expressed renewed interest in peaceful applications of nuclear power. Some seek to expand nuclear infrastructures already in place; others are pursuing commercial nuclear applications for the very first time.

Nowhere has this trend been more pronounced than in the Middle East. Although many nations in the region have long had small research reactors, it only has been during the past ten years that peaceful nuclear projects have begun to gain momentum.

- Iran, of course, was the first Middle Eastern nation with ambitions for peaceful uses of nuclear energy, dating back to the Shah's regime and the US Atoms for Peace program. Iran's long-standing effort to build and operate a power reactor at Bushehr, with Russian help, would probably have been fulfilled by now, if not for the complications introduced by Iran's apparent ambitions for nuclear weapons. Tehran's efforts to enrich uranium, despite the absence of any identified non-military requirement for the product in Iran, to say nothing of Tehran's repeated conflicts and non-compliance with International Atomic Energy Agency (IAEA) procedures, have raised serious concerns about Iran's intentions with respect to its commitment, as a signatory that has ratified the Nonproliferation Treaty, not to develop nuclear weapons. This problem will be discussed further elsewhere in the report.
- Other nations along the Gulf also have announced plans to use nuclear energy for power and desalination plants. In April 2010, Saudi Arabia announced creation of the *King*

Abdullah City for Nuclear and Renewable Energy and plans to invest in research and training to support diverse energy sources, including nuclear. The United Arab Emirates (UAE) has already contracted with a South Korean-led, multinational consortium to build one reactor by 2017 and has plans to build three more by 2020.¹ In addition to signing a nuclear cooperation agreement with France in January 2008, the UAE is the first country in the region to secure full US nuclear cooperation by signing the “123 Agreement” in late 2009, pledging to import its nuclear fuel and forgo nationally-owned enrichment and reprocessing plants – two key nodes in the nuclear fuel cycle at which fissile materials nominally used for peaceful purposes could be diverted to weapon programs.² This forbearance on the part of the UAE sets a constructive precedent and is a useful step toward nuclear surety, which will be elaborated upon elsewhere in the report.

- In the broader Middle East, Algeria, Egypt, Israel, Jordan, and Turkey, among other nations, all have announced plans for growth in their nuclear power industries and are making varying degrees of progress toward their goals.³ In terms of their impact on prospects for a compatible nexus between expanding nuclear industries and diminishing risks of regional nuclear arms race, however, Jordan’s plan is the most problematic. Having newly discovered substantial uranium deposits on its territory, the Jordanian government envisions developing a profitable reactor fuel industry, including mining, refining, and enriching the ore. As a result, unlike the UAE, Amman is resisting US entreaties to pledge to refrain from developing uranium enrichment facilities.⁴ If Jordan retains this position, it obviously will complicate efforts to persuade Iran to give up its own capabilities.

In short, the nuclear renaissance is in full bloom in the Middle East. These plans were discussed at the workshop and are elaborated upon later in this report. A key question, however, is whether or not the growth of civil nuclear industries can continue without jeopardizing the simultaneous international drive toward reducing nuclear weapons. That will depend on whether governments prove willing to forgo nationally-owned uranium enrichment and reprocessing facilities in support of evolving multinational norms.

PROGRESS TOWARD NUCLEAR DISARMAMENT

It is ironic, perhaps, that coincident with the renaissance in nuclear power has come a renewed global drive to eliminate nuclear weapons. Retired foreign and defense ministers from South

¹ Nuclear Engineering International “KEPCO Wins UAE Civil Nuclear Bid.” January 4, 2010.

² Embassy of the United Arab Emirates. “US-UAE 123 agreement enters into force” December 17, 2009. <http://www.uae-embassy.org/media/press-releases/17-Dec-2009>

³ Sharon Squassoni, *Nuclear Energy: Rebirth or Resuscitation?* (Carnegie Endowment for International Peace, 2009), p. 57.

⁴ Jay Solomon. “Jordan’s Nuclear Ambitions Pose Quandary for the U.S.” Wall Street Journal. June 12, 2010. http://online.wsj.com/article/NA_WSJ_PUB:SB10001424052748704414504575244712375657640.html

Korea are the latest of the “gangs of four” high-ranking officials joining those from the Britain, France, Germany, India, Russia, and the United States to advocate for the total elimination of nuclear weapons from all nations.⁵ President Obama officially embraced the goal for the United States in his April 2009 Prague speech. In May 2010, President Medvedev committed Russia to the same objective.⁶ In September, the presidents of the fifteen members of the UN Security Council, including the five permanent members, all of whom are nuclear weapon states, committed their countries to seek “the peace and security of a world without nuclear weapons.”⁷

These words have been backed by concrete actions. As the nations with the largest nuclear arsenals, the US and Russia recognize their responsibility to act first. In April 2010, they concluded the new START agreement, a treaty that will reduce their respective operational warheads for long-range weapons by one-third from the previously agreed limit. That same month, President Obama convened a “Nuclear Security Summit” in Washington, at which 47 nations committed themselves to securing all fissile materials by 2014 and to pursuing a work program and series of milestones toward that end.

In May, the 189 signatories of the Nonproliferation Treaty met in New York for the required quinquennial review of the agreement. Unlike the previous two reviews, the atmosphere was cooperative and the participants were able to agree to a consensus document laying out a comprehensive set of objectives for reducing nuclear risks and moving toward nuclear disarmament. Of greatest relevance to the Middle East and a source of considerable controversy, the document calls on Israel to accede to the NPT and to place all its nuclear facilities under IAEA safeguards. It further calls for a conference in 2012 of all Middle Eastern states to discuss the establishment of a Middle East zone, “free of nuclear weapons and all other weapons of mass

⁵ For examples, see: Helmut Schmidt, Richard von Weizsäcker, Egon Bahr, and Hans-Dietrich Genscher. “Declaration on Freedom from Nuclear Weapons” (*Internationale Diplomatenausbildung der Akademie Auswärtiger Dienst*, May 6, 2009), 21 September 2009

www.diplomatie.diplo.de/index.php?option=com_content&task=view&id=145&Itemid=423; George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, “A World Free of Nuclear Weapons,” *Wall Street Journal*, January 4, 2007; George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, “Toward a Nuclear-Free World,” *Wall Street Journal*, January 15, 2008; Douglas Hurd, Malcolm Rifkind, David Owen, and George Robertson, “Start Worrying and Learn to Ditch the Bomb,” *The Times*, June 30, 2008; K. Subrahmanyam, “When Hawks Turn Moral,” *Indian Express*, January 21, 2008; Alain Juppe, Michel Rocard, General (Ret.) Bernard Norlain and Alain Richard, “Pour un désarmement nucléaire mondial, seule réponse à la prolifération anarchique,” *Le Monde*, October 14, 2009; Lee Hong-koo, Han Sung-joo, Park Kwan-yong, and Paik Sun-yup. “A Road Map for a Nuclear Free World,” *Joong Ang Daily*, June 23, 2010. <http://joongangdaily.joins.com/article/view.asp?aid=2922187>.

⁶ Reuters. “Russian President Dmitry Medvedev Submits US Nuclear Arms Deal to Parliament” *The Christian Science Monitor*. May 28, 2010. <http://www.csmonitor.com/From-the-news-wires/2010/0528/Russian-President-Dmitry-Medvedev-submits-US-nuclear-arms-deal-to-parliament>

⁷ “Historic Summit of Security Council Pledges Support for Progress on Stalled Efforts to End Nuclear Weapons Proliferation: Resolution 1887 (2009) Adopted with 14 Heads of State, Government Present” United Nations Security Council Department of Public Information, News and Media Division. September 24, 2009. <http://www.un.org/News/Press/docs/2009/sc9746.doc.htm>

destruction,” and specifies preliminary steps to make that conference a reality.⁸ The NPT Review did not reference international concerns about Iran’s nuclear activities.

The Riyadh workshop, “Nuclear Dangers, Nuclear Realities,” was thus convened at a most auspicious time. The long-standing strategic fault lines in the Middle East – between Israel and the Palestinians, and between Iran and its neighbors – to say nothing of the localized differences both between and within Middle Eastern nations, make the specter of nuclear proliferation in this region particularly dangerous, compounded by its proximity to South Asia with its own nuclear instability issues. Yet the *status quo*, in which only one country in the immediate region, Israel, has nuclear weapons (albeit undeclared), and a few other states hold chemical, and possibly biological, weapons, is neither stable nor politically sustainable. In the past, diplomats and political leaders ignored this asymmetry, and believed that solving the Palestine issue was prerequisite to addressing the nuclear weapons issue. But as the impasse between Israel and Palestine drags on, and nuclear technologies become more readily available to any state willing to invest the necessary resources, the dangers of proliferation and nuclear terrorism, as well as the complications of controlling escalation so as to avoid nuclear use in a multi-polar regional crisis, loom large.

With nuclear energy programs accelerating in several states, it is essential to think anew about the nuclear rights and responsibilities of all nations – both weapon states and non-weapon states. A renaissance in peaceful nuclear applications and meaningful progress toward the elimination of nuclear weapons are not necessarily incompatible; indeed, they may each be feasible only if carried out in conjunction with one another. Many ideas have been tabled about how to expand nuclear energy industries without increasing proliferation risks – most importantly, proposals to place all enrichment and reprocessing facilities under multinational controls. Nowhere are such ideas more relevant and necessary than in the Middle East. It was with this imperative in mind that the participants in the workshop addressed the nuclear future.

⁸ Stephen Kaufman. “NPT Review Conference Affirms Obama’s Nonproliferation Agenda: U.S. to Co-sponsor Proposed 2012 Conference on WMD-free Mideast.” Bureau of International Information Programs, U.S. Department of State. June 01, 2010. <http://www.america.gov/st/peacesec-english/2010/June/20100601133524esnamfuak0.697735.html>

NEW TRENDS IN MIDDLE EASTERN ENERGY POLICIES

The recent renewed interest in nuclear energy in the Middle East appears to be driven in part by economic conditions. While the vast energy resources of the Middle East would make it seem that the pursuit of nuclear energy is a question of choice, the region's comparative advantage in hydrocarbon energy is offset by demographic pressures, harsh environmental conditions, and finite energy reserves. Facing fast-expanding populations, declining water tables, and rapid industrialization, the region is already encountering shortages and must act quickly to find new solutions to meet its own future energy demands. Diversification of energy will be a high priority for most of the states of the Middle East in the foreseeable future, so that they do not have to curtail their principle revenue-generating export to keep their domestic economies functioning.

This trend is not exclusive to the Middle East, but is connected to a larger global nuclear quest that includes both developed and developing states. Driven by rising costs of energy, increased pressure to use cleaner fuels, and the fading memory of past nuclear accidents, the global community is showing a renewed interest in peaceful nuclear technology. Nations planning to construct and upgrade nuclear facilities include leading economies such as the United States and Germany. Meanwhile, traditional opposition to nuclear energy is declining; Sweden abandoned its 1980 nuclear energy phase-out policy, and after decades, Italy has decided to reintroduce nuclear facilities to its power grid. However, development in nuclear energy is most intensive in the developing world, especially in Asia where 36 of 54 of the world's developing nuclear programs in 2009 are located. Though operating only 11 reactors, China is stockpiling uranium far beyond its current needs in anticipation of rising prices. Rising global demand for uranium may prompt Australia, which currently possesses nearly a quarter of the world's known recoverable uranium, to engage in commercial enrichment. In sub-Saharan Africa, despite the enormous challenges of funding and implementation, Namibia and Nigeria have each expressed interest in civil nuclear power. In Latin America, Chile, Venezuela, and Uruguay also plan to add nuclear power to their energy portfolios while Argentina, Brazil, and Mexico desire to double and triple their current nuclear capacity.

This trend is also being driven from the supply-side of the industry, which is robust and competitive. Current trends suggest that global energy in the upcoming decades will include nuclear components. As of June 2008, a total of 372 GWe (Gigawatt-electric) was generated globally by 480 nuclear reactors (including 41 under construction). The Nuclear Energy Association projects the high and low nuclear energy output estimates for 2050 to be 1400 GWe and 580 GWe, respectively. Meeting these demands will require 23 to 54 new reactors annually.⁹ Historic providers of nuclear reactors (United States, France, Canada, Russia, Japan, and Britain) also face competition from rising nuclear export industries such as in South Korea. The efficiency and safety standards of the latest Korean model, the APR-1400, which provides nearly

⁹ Nuclear Energy Agency. "Nuclear Energy Outlook 2008." OECD Publishing, p. 28.

half of Korea's domestic energy needs, claims to surpass its French equivalent by 23 percent in cost efficiency, and is believed to be capable of absorbing the destructive impact of an aircraft.¹⁰

Whether the world's current level of interest in nuclear energy will endure depends on the economic and environmental costs and benefits of this energy source as compared to available alternatives, including fossil fuels. The economic calculus will vary from state to state depending on the availability and economic value of natural resources, geographic and infrastructure constraints, and access to the capital necessary to invest in nuclear infrastructure. For example, one kilogram of natural uranium will produce 20,000 times more energy than the same amount of coal, but constructing a reactor costs no less than \$5 billion and can run as high as \$11 billion.¹¹ Likewise, the terrain, climate, seismic stability, and access to uranium supplies can drastically alter the comparative benefits and costs of relying on wind, solar, or nuclear energy sources. Jean Francois-Seznec, Georgetown University, also incorporates opportunity costs into the calculus, such as the market value of fuels and their related products, carbon credit trading, and the effects on domestic and international politics.

NUCLEAR ENERGY IN THE MIDDLE EAST

Among Gulf States, only the UAE and Iran have officially submitted target dates to the IAEA, but virtually all Middle Eastern countries, with the possible and not permanent exceptions of Lebanon and Iraq, have officially expressed interest in acquiring civilian nuclear programs.¹² Realizing this goal requires great financial investment, long-term commitment, and assumption of greater responsibility. Khalid Aleissa, King Abdulaziz City for Science & Technology, outlined the fundamental components that national nuclear programs must have to be successful and safe:

- National capacity to ensure the safety and security of facility maintenance, fuel procurement, and waste management;
- Human resource development through education, training, and research;
- Legislation and regulatory framework;
- Nuclear power plant (NPP)

Obtaining the aforementioned components will also require assistance and support from the international powers controlling the flow of nuclear technology. This is most easily achieved by recognizing the guidelines of the Nuclear Supplier Group (NSG) and the safeguards of the IAEA. Generally, NSG trade partners are signatories of the NPT, and the transfer of weaponry and

¹⁰ The Korea Times. "Korea Boasts Global Competitiveness in Nuclear Tech" April 14, 2010. http://www.koreatimes.co.kr/www/news/biz/2010/05/291_64190.html

¹¹ The World Nuclear Association. "The Economics of Nuclear Power." July 2010. <http://www.world-nuclear.org/info/inf02.html>

¹² Squassoni, p. 57.

enrichment technology is strongly discouraged; however, recent exemptions by the US (India 2008) and China (Pakistan 2010) illustrate the benefits of having the support of “powerful friends.”¹³ As a result, suppliers and countries seeking nuclear technology often sign multiple agreements with multiple nuclear vendors. The UAE has signed agreements with France, Britain, Russia, China, Japan, Germany, South Korea, and the US. The full support of Washington, formalized through the so-called 123 Agreement, is often considered the gold standard.¹⁴

1. GULF COOPERATION COUNCIL (GCC)

In December 2006 at the GCC summit in Riyadh, member states adopted a proposal to begin investigating the viability of establishing a joint, peaceful, nuclear program. Under the GCC Secretariat, a team was created in 2007 to prepare a pre-feasibility study conducted with experts from the International Atomic Energy Association (IAEA). Subsequently, the IAEA and nuclear agencies of GCC members launched a program of studies and workshops designed to assist members in establishing the appropriate legislation, infrastructure, and training to ensure standards of efficiency, safety, and nonproliferation. The second of two workshops, which brought 80 GCC delegates to be trained in establishing nuclear safety legislation, was concluded in June 2010, in Abu Dhabi.

The GCC has faced challenges in bringing a common nuclear energy program to fruition. First, countries could not agree on which country should host the reactor. To date, cooperation has been limited to the construction of a shared, high capacity power-grid that connects oil and gas power plants in Saudi Arabia, Kuwait, Qatar, and Bahrain; the UAE will be integrated in 2011.¹⁵ Eventually the grid will connect southern GCC members and efficiently distribute excess power to minimize blackouts, facilitate regional energy trade, and create the necessary infrastructure to handle greater voltage.¹⁶ However, in pursuing nuclear energy, GCC countries and their immediate neighbors have proceeded at different paces and with different priorities:

- The UAE has signed a 123 Agreement with the United States and has selected Korea as its partner for the construction of four nuclear reactors.
- Saudi Arabia, Jordan, and Kuwait are conducting feasibility studies and investing in developing indigenous human resources and national capacity.
- Bahrain, Qatar, and Oman have shown far less interest in nuclear energy. They judge that natural gas is more economical for their requirements.

¹³ “The Power of Nightmares” Economist June 26, 2010, p. 61.

¹⁴ 123 Agreements refer to Section 123 of the 1954 Atomic Energy Act; these bilateral agreements govern US nuclear cooperation with partners and are required for nuclear trade.

¹⁵ Al Bawaba. “Upcoming Gulf Power Grid to Meet Demand for Extra 55,000” June 24, 2010. <http://www.menareport.com/en/business/317825>

¹⁶ International Institute for Strategic Studies. “UAE Leads Gulf Nuclear-Power Plans” Vol. 16, Strategic Comment 7 – February 2010.

Figure 1: Future Population, Water, and Energy Demand in the Middle East¹⁷

	Projected Population (Millions) ¹⁸		Renewable Water Per Capita (Cubic Meters) ¹⁹		Energy Demand (Terawatt/hour) ²⁰	
	2010	2030	2010	2030	Recent	2030
Saudi Arabia	26.2	36.5	92	66	87	156
UAE	4.7	6.6	32	23	74	191
Kuwait	3.1	4.3	6	5	52	145
Bahrain	0.8	1.1	150	109	11	30
Qatar	1.5	2.0	39	29	17	26
Oman	2.9	4.0	483	350	12	21
Iran	75.1	90.0	1,831	1,528	156	370
Yemen	24.3	39.4	86	53	4	9
Jordan	6.5	8.6	145	109	8	18
Egypt	84.5	111.0	678	516	123	407
Turkey	75.7	90.4	2,822	2,363	152	360

2. SAUDI ARABIA

Though it is the world's leading energy exporter, the Kingdom of Saudi Arabia will explore new strategies to meet the Kingdom's growing energy demands and preserve its hydrocarbon resources. Only days following the "Nuclear Dangers, Nuclear Realities" workshop, on April 17, 2010, King Abdullah announced plans to open a new center in Riyadh, the *King Abdullah City for Nuclear and Renewable Energy* (KACNRE). The KACNRE will not only house nuclear reactors and conduct research in alternative energy sources, but will also serve as the Kingdom's representative to the IAEA. It represents a tangible expression of Saudi Arabia's nuclear commitment. Meanwhile, the Kingdom continues to seek international partners to develop a foundation for a future nuclear program.

¹⁷ The combined assessment of projected population, renewable water per capita, and energy demand in these nations in 2010 and 2030 provides a full picture of the central components pushing for the expanded production of desalinization plants, which require significant amounts of energy to operate and produce more freshwater for increasing populations. Additionally, figures on energy demand in the future help reveal the potential for energy shortages if the demand for desalinization plants rise, which in turn provides a viable reason for these nations to develop alternative sources of energy, including nuclear sources. Drafted by Lilly Frost, the Stimson Center.

¹⁸ United Nations Population Division. "World Population Prospects: 2008 Revision Population Database." <http://esa.un.org/unpp/>

¹⁹ Author's calculation based on projected population and renewable water annual data respectively from: United Nations Population Division. "World Population Prospects." and the United Nations Environment Programme "Global Environment Outlook." <http://geodata.grid.unep.ch/>

²⁰ "Water and Energy Linkages in the Middle East: Regional Collaboration Opportunities" Edited by Jakob Granit and Rebecca Löfgren. Stockholm International Water Institute (SIWI) Paper 16. April 2010. p. 13 http://www.siwi.org/documents/Resources/Papers/Paper16_Water_and_Energy.pdf

- **June 2010:** The Kingdom sent a delegation to the *Arab Conference on the Prospects of Nuclear Power for Electricity Generation and Seawater Desalination* in Tunisia.
- **June 2010:** The Kingdom hired a Finnish engineering firm, Poyry, to do an analysis of the economic viability of each phase of the nuclear energy generation process.²¹
- **May 2010:** The Kingdom agreed to cooperation and dialogue with Japan toward atomic energy and water.
- **April 2010:** The *King Abdullah City for Nuclear and Renewable Energy* (KACNRE) was established.
- **May –December 2009:** Negotiations were made with France and Russia on civilian nuclear cooperation agreements.
- **May 2008:** Memorandum of Understanding was signed with the United States.

As illustrated above, the Kingdom is seriously exploring how it can incorporate nuclear energy into a diverse portfolio of energy sources. In light of the complex cost-benefit analysis of nuclear programs, Saudi Arabia's priority is to generate an indigenous capacity to research and maintain multiple sources of energy. Workshop participants Saleh Al-Mani, King Saud University, and Giacomo Luciani, Gulf Research Center (Geneva), predict that a rational future energy portfolio in the Saudi Arabia must be "multi-dimensional," including an ambitious nuclear component to supplement solar power and hydrocarbon fuels. Like Saudi policymakers, Al-Mani believes that a successful nuclear program will depend on the educational programs to train new nuclear engineers capable of running third generation nuclear technology. Unlike the UAE and Jordan, whose energy demands are more urgent, the Kingdom's vast energy reserves permit more time to build this capacity in a deliberate and measured way.

Driving this policy shift are demographic and market trends that make the continued reliance on hydrocarbons to meet domestic energy demands costly and unsustainable. While Saudi Arabia's reserves are vastly larger than other GCC members, they are nonetheless finite, as is the Kingdom's OPEC export quota for oil. Meanwhile, domestic power demand will continue to increase as a doubling population consumes more electricity and water. Al-Mani emphasizes that the region's pending water crisis must be met with more efficient methods of desalination, which supplies 70 percent of the nation's drinking water. Currently, to meet its domestic demand, Saudi Arabia utilizes 15 percent of its daily oil production. This figure is expected to rise to 20-25

²¹ The Daily Star. "Saudi Arabia May Enrich Uranium for Nuclear Power Plants" June 18, 2010. http://www.dailystar.com.lb/article.asp?edition_id=10&categ_id=2&article_id=116084#axzz0rX0ybsHY

percent by 2030. In general, electricity demand in Saudi Arabia is expected to rise at a rate of five to seven percent annually.²²

Whether to invest in nuclear energy is a question complicated by a balance of economic and other kinds of costs and benefits. The economic calculation for a country with copious gas and oil reserves will depend on market prices of those resources (and their related products) as well as the comparative cost of alternative energy technologies. Workshop participant Jean-Francois Sez nec illustrates this complexity with a comparison between natural gas and nuclear energy. In light of the marginal efficiency of nuclear energy and its high up-front capital costs, the low cost of natural gas in the Kingdom (\$0.75/mmbtu- measured in British Thermal Units) compared to the global market price (\$6.0/mmbtu:), renders nuclear energy uneconomical. However, domestic oil and gas consumption also carry opportunity costs. Sez nec points out that when used to produce products such as methanol, urea, and diammonium phosphates (DAP), the profits from natural gas can be multiplied. Non-economic factors include those that impact the physical and political environment, such as the costs of carbon emissions and the health effects of air and water pollution. In the political sphere, attaining the status of a nuclear state or pursuing cleaner energy policies can yield influence or even an economic benefit in the form of the sale of emission rights. At the same time, the management and protection of nuclear energy facilities and waste can also include environmental and safety risks.

In light of the factors described above, Saudi Arabia's policy of supporting mixed sources of energy is an insurance policy against investing too heavily in one source of energy. Likewise, the decision to develop indigenous research facilities and to train engineers strives to preserve the Kingdom's autonomy and influence in the global energy market. Sez nec points out that the fear of dependency on nuclear fuel and technology comprises three prongs of vulnerability from the producers of raw and enriched uranium as well as providers of technology. Though Saudi Arabia "stated its intent to rely on international markets for nuclear fuel and to not pursue sensitive nuclear technologies" in its 2008 MOU with the US, the KACNRE has commissioned a Finnish engineering firm to draft a future national nuclear strategy that does not exclude fuel enrichment in the long run, but will likely outsource it in the shorter term.²³ Under these conditions, the Kingdom will likely not follow the model of UAE-US cooperation. Developing national facilities and human resources will also allow Saudi Arabia, following South Korea's example, to develop its nuclear capacity as a possible basis for future exports and revenue.

Saudi Arabia's endeavor to create an indigenous nuclear program, as part of a multi-dimensional energy portfolio, will likely continue under the current circumstances. Jean Francois Sez nec argues that, though economic viability will require further analysis, nuclear energy makes sense for the GCC. Saleh Almani deems it "feasible and attractive" if the proper human resources and

²² US Department of Energy. "Saudi Arabia: Electricity" Energy Information Administration. http://www.eia.doe.gov/emeu/cabs/Saudi_Arabia/Electricity.html

²³ The Daily Star. "Saudi Arabia May Enrich Uranium for Nuclear Power Plants" June 18, 2010.

legal framework are established with the IAEA. Another workshop participant, Giacomo Luciani, sees a clear benefit to Saudi Arabia in quickly developing its nuclear energy capability.

3. THE UNITED ARAB EMIRATES

With the purchase of nuclear reactors from the Korean Electric Power Co. (KEPCO), the first of which will be completed by 2017, the UAE is on track to become the first nuclear Arab Gulf state. Its progress is further buttressed with the full support of the United States following the UAE's successful completion of the 123 Agreement, in which it agreed to forego its right as an NPT signatory to produce its own fuel. This commitment facilitates Washington's cooperation by allaying fears of the proliferation of sensitive nuclear technology in the region.

The UAE's ambition may reflect the gravity of its energy needs as well as its financial ability to import technology and human resources, estimated by Al-Mani to cost \$40 billion by completion. In light of the UAE's limited gas and oil supplies and its high energy consumption, the benefits of adding nuclear energy to its portfolio are clearer than they are for Saudi Arabia. The UAE has concluded that, even with an economic slowdown, it faces an energy demand growth rate of nine percent, leading to a substantial energy deficit by 2020 (40,000 MWe).²⁴ As the world's leading dependent on water desalination, the UAE produces 1.7 billion cubic meters of fresh water annually. With water tables expected to drop by 16 percent in the next ten years, the UAE faces a pending water crisis, to be compounded as the population doubles by 2050.²⁵ As with Saudi Arabia, the UAE believes that energy diversification is the answer to these challenges.

4. JORDAN AND EGYPT

Both Jordan and Egypt believe that nuclear energy is a feasible alternative source of energy to meet their growing demands; however, both nations lack the necessary capital. In 2007, Egypt announced plans to meet its growing energy shortages (seven percent annually) with the construction of 10 nuclear powered electric stations. It has invested money in consultancy services and studies, but still faces the challenge of raising the necessary \$1.5 billion for its first reactor.²⁶ Similarly, Jordan established the Jordan Atomic Commission (JAEC) and the Jordan Nuclear Regulatory Commission (JNRC) in 2008 to reach its goal of 30 percent nuclear power by 2030. Because of its energy and water crisis, Jordan is taking its nuclear development seriously, engaging in competitive negotiations with suppliers. After cancelling a \$130 million contract with KOPEC to construct a 5 MW research reactor by 2015, it continues to negotiate with Russian, French, and Canadian firms. Its most challenging negotiation is with the United States, which opposes Jordan's plans to enrich uranium. A recent discovery of an estimated 65,000 tons of

²⁴ The Embassy of the United Arab Emirates. "Peaceful Nuclear Energy." June 15, 2010. <http://www.uae-embassy.org/uae/energy/nuclear-energy>

²⁵ Deena Kamel Yousef. "Private players eye UAE water market" Gulf News, Jun 04, 2010. <http://gulfnews.com/business/general/private-players-eye-uae-water-market-1.636438>

²⁶ BBC News "Egypt Unveils Nuclear Power Plan" September 25, 2006. http://news.bbc.co.uk/2/hi/middle_east/5376860.stm

uranium ore (tU) and 1.5 billion tons of phosphates (which contain 130,000 of tU) has caused Jordan to reconsider its previous understanding with the United States, that it would import nuclear fuel. Unlike the GCC countries, Jordan lacks water and the ability to subsidize or export hydrocarbons and is currently spending a quarter of its budget importing 95 percent of its energy.

5. KUWAIT, BAHRAIN, QATAR, AND OMAN

Kuwait, Bahrain, Qatar, and Oman face similar issues of rising energy and water demands as their populations expand and water supplies diminish. Each of these states is carefully examining a nuclear solution to meet these needs; however, factors such as infrastructure, resource supplies, and market prices change the calculus for each state.

Kuwait is conducting a feasibility study for nuclear energy, which is due to be concluded in early 2011. Though Kuwait is not engaged in any nuclear activities, the Kuwaiti Committee for the Peaceful Usage of Atomic Energy (established in 2009) has been tasked with establishing the ground work for a nuclear program. It has signed cooperation agreements with France, Jordan, and Japan (June 2010). More recently, a Memorandum of Cooperation for developing legislation/regulation, human resources, safeguards/security, and waste management was signed with the United States.

Since the economic slowdown began in 2008, Bahrain, Oman, and Qatar have questioned the viability of pursuing nuclear programs. Though Bahrain (along with Oman) officially joined the IAEA in 2009, its nuclear ambitions have stagnated since signing a Memorandum of Understanding with the US for nuclear cooperation and another with Russia for scientific exchanges in 2008. Likewise, Omani officials announced their plan to focus on solar and wind power rather than nuclear due to the high costs and the inadequacy of Oman's power grid to handle the output from nuclear power plants. Yet the establishment of a civilian nuclear energy agency and a deal with Russia in 2009 to pursue basic nuclear research suggests it has not ruled out nuclear energy as a part of its long-term energy strategy.²⁷ While less sensitive to costs, Qatar delayed implementing its previously announced 10-year nuclear plan. The limited capacity of its power grid, the global liquidity crisis, and the unpredictability of market energy prices have complicated its cost-benefit analysis of switching to nuclear energy. Like Oman and Bahrain, Qatar's power grid is insufficient for large nuclear reactors and would work best with smaller reactors (300 -600 MWe), which are not yet available on the commercial market.²⁸ The political and economic uncertainty in the region and the possibility of importing energy from a regional power grid complicates the feasibility equation of investing in a national nuclear program for all four states.

²⁷ Mark Hibbs, "Size of Grid, Load Profile Could Keep Oman from Building Nuclear Plants." *Nucleonics Week*. November 13, 2008. Pg. 14 Vol. 49 No. 46.

²⁸ Mark Hibbs, "Qatar finds Power Reactor Option Requires More Detailed Examination." *Nucleonics Week*. November 13, 2008. Pg. 13 Vol. 49 No. 46.

THE GEOPOLITICAL SETTING

Discussions of nuclear issues in the Middle East are contentious and complicated. The region comprises the Arab states, Israel, Turkey, and Iran. Of these, most are signatories to the nonproliferation treaty. Israel and Iran pose the most important challenges: Israel is a non-declared nuclear weapons state and non-signatory of the NPT; Iran is not in full compliance with its NPT obligations and many fear that it is moving quickly to becoming a fully capable nuclear state, with or without an arsenal of weapons.

The Arab world has generally eschewed nuclear weapons, and has generally used only modest levels of nuclear technology for research, medicinal, and other purposes. Iraq was an important exception and, in the 1980s and 1990s, worked on an ambitious and secret nuclear weapons program. Its program was undermined by the sanctions and inspections of the 1990s. By the time of the 2003 US invasion, Iraq's advanced weapons program had been dismantled. The history of Iraq's WMD programs was recorded in the final report of the Iraq Survey Group in 2004.

Historically, it has been Israel's nuclear capability that has most shaped Arab policies on nuclear questions. For some states, like Syria, this has led to the development of alternative nonconventional weapons (chemical weapons in particular) in a bid to offset the asymmetry with Israel. For other states, such as Egypt, it has led to a sustained policy commitment to reduce and eliminate nuclear weapons regionally and globally. Egypt's able diplomats have been leaders of the global south in arms control and disarmament debates.

More recently, it has been the concerns about Iran's nuclear intentions and capabilities that have primarily shaped the discussion in the Middle East. Arab states face conceptual and political dilemmas: they may find Iran's potential nuclear status even more threatening than Israel's, due to the enduring concern over Iranian hegemonic ambitions and inter-Islamic rivalries and tensions, but they also feel some solidarity with Iran's protestations about double standards favoring Israel over its neighbors. They see a fundamental lack of fairness and balance when the international community places such a priority on stopping Iran's program, while it has tacitly acquiesced to Israel's for several decades.

The concerns about Israel and Iran have galvanized Arab states, led by Egypt, to focus on gaining international support for a weapons of mass destruction free-zone in the Middle East. Such a concept was first addressed formally in the 1995 NPT Review Conference. It was later embraced by the Gulf Cooperation Council, which offered over the last decade to implement it first in the GCC; and most recently, was featured prominently in the May 2010 NPT Review Conference.

The May 2010 final document's call for a Middle East weapons of mass destruction-free zone and a 2012 conference is an important milestone in Middle Eastern nuclear policymaking, but it may not produce early success in altering the nuclear policies of either Iran or Israel. Iran was

spared any direct criticism at the NPT Review, which may have deepened its sense of invincibility. Iran also worked with Turkey and Brazil on a fuel swap arrangement that they believed would be a breakthrough in the impasse, but the terms of the agreement were seen by the major powers as insufficient, thus creating further confusion and controversy. The lack of resolution about Iran's willingness to meet international and IAEA demands for greater transparency and cooperation led to new UN Security Council sanctions in June. By late summer, Iran signaled its interest in resuming nuclear talks with the P5 + 1 (the five permanent members of the UN Security Council plus Germany).

As for Israel, it will not respond favorably to the NPT Review Conference plan for a conference in 2012. The United States reluctantly agreed to the 2012 conference idea in order to achieve consensus on the overall document, but insists that it cannot be expected to deliver Israel against its will to such a meeting. Israel will make its decision as a sovereign state. The Arabs and at least part of the international community will likely be more than disappointed if the 2010 document does little to arrest the region's growing nuclear dangers.

The larger geopolitical realities in which the nuclear issue is addressed include longstanding conflicts and newly emerging sources of instability. Among the issues are: the chronic failure to make progress on the Arab-Israel conflict; the acute humanitarian and political crisis over Gaza; the uncertainties about Iraq's future; the simmering tensions between Sunnis and Shia triggered first by Iran's intervention in Lebanon and more recently by civil strife in Iraq; and the systemic weakness of governance across the region that has contributed to radicalization of youth. These realities suggest that it will be exceedingly difficult for the region to generate and embrace innovative thinking, or work in an atmosphere of cooperation and trust on the nuclear question.

In theory, the emergence of interest in nuclear power for electricity generation on the part of many of the states of the region creates opportunities for fresh thinking. It reminds the international community to help these states relearn their nonproliferation responsibilities. The regional states can make efforts to consult with other states and regions about best practices in nuclear safety and security, as they consider the business and engineering aspects of acquiring nuclear energy. They may also see economic benefits to regional, rather than national, structured programs. It should not be beyond our imagination to consider international or multinational solutions for the fuel cycle and for waste management that could shape outcomes in the Iran case. Some Arab states, including Gulf states, endorse the internationalization of the fuel cycle and of nuclear waste disposal; can these ideas lead to policies that can positively affect the ongoing crisis over Iran's program, which in turn could encourage a rethinking of the status quo in Israel?

GLOBAL GOVERNANCE OF NUCLEAR ISSUES IN 2010

It is clear that a significant expansion of nuclear energy could hasten a destabilizing chain of proliferation activities around the world. Recognizing these realities, some members of the international community have been working diligently to prepare for the safe expansion of nuclear energy by rethinking reactor designs, offering innovative alternatives to the fuel cycle, and introducing supplemental efforts to fill the gaps of a nonproliferation regime increasingly strained by modern realities. Together, these efforts represent a fundamental shift in the global governance of nuclear issues. Regrettably, these efforts could not come at a more complicated moment in history, as tensions between the “nuclear haves” and the “nuclear have-nots” are once again rising, and both the ambitions and the ability of non-nuclear weapons states—or even non-state actors—to acquire a weapons capability is growing with the democratization of technology itself. Today, more countries than ever before—many of whom have never been considered “WMD capable”—are forming potential links in the nuclear weapons supply chain as technology innovators, dual-use manufacturers, financiers, or transshipment hubs. As a result, traditional strategies designed to contain proliferation are proving increasingly insufficient at best and at worst, anachronistic.

In short, unless a strategy that ensures that the utilization of nuclear energy can be accomplished without encouraging or enabling nuclear weapons proliferation, the viability of the nuclear renaissance itself will be called into question. At the same time, any serious delay in addressing pressing energy demands—including in the Middle East—could cause serious disruption to national economies as well as to social stability and national security. A number of ideas to mitigate these dangers are worthy of attention:

STRENGTHENING OF THE DENIAL REGIME

Prior to the exposure of the A.Q. Khan black market nuclear network, strategies to address the proliferation phenomenon became ever more focused on technology denial—including export controls, strengthened and expanded safeguards, sanctions, and even regime change. The cornerstone of that regime was laid in 1968, with the conclusion of the NPT. There, the so-called “grand bargain” was struck whereby non-nuclear states pledged not to seek atomic weapons, while the five declared nuclear states agreed to move toward total and complete disarmament. Significantly, the NPT also confirmed the rights of all signatory states to acquire peaceful nuclear technology and enjoined nuclear supplier countries from prohibiting or unduly restricting the technology provided it was for peaceful application.²⁹ Even still, the lion’s share of effort and resources focused on curbing the spread of nuclear weapons, technology, and know-how to additional states beyond the permanent five members of the Security Council. From the 1960s through the 1980s, new regional nuclear weapons-free zones, limitations on nuclear testing, and technology-control agreements and measures grew in support of the denial objectives of the NPT.

²⁹ Khalid Aleissa, “The 21st Century Opportunity and Risk of Nuclear Energy,” King Abdulaziz City for Science & Technology, Riyadh, April 2010.

The entry-into-force of the NPT helped temper the overt pursuit of the bomb beyond the five nuclear weapons states, even while the superpowers grew their arsenals. Over time, the non-nuclear weapons states grew increasingly agitated over the perceived unwillingness of their nuclear-armed counterparts to engage in meaningful disarmament. These divisions gradually had a negative impact upon the nonproliferation components of the regime, as exemplified by a growing unwillingness of many, particularly within the Non-Aligned Movement, to accede to more rigorous preventive measures.

Then, in the 1980s, proliferation experts were again sounding alarms. This time, the locus of concern was not on the developed states of the north, but on developing states of the global south. Up to 18 developing countries were thought to be harboring nuclear ambitions, including Argentina, Brazil, Syria, Iraq, Nigeria, and Libya. By the early 1990s, Pakistan and South Africa were joined by Iran, North Korea, and Taiwan as potential breakout states.

The apocalyptic projections of 18 to 20 new nuclear-armed states in the 1980s proved false.³⁰ Vertical proliferation in the late 20th century was rampant, but the restriction of nuclear status to eight at the turn of the millennium was testament to the relative stability in global political and economic relations. Today, however, in the face of burgeoning energy demands, and in a world of globalization, privatization, and expanding economic development, it is clear that the technology denial regime is again under severe pressure. The failure to expose earlier the operation of the non-state Khan network and the gradual expansion in the number of de facto weapons states has underscored the need to buttress the nonproliferation regime with a more sophisticated approach to technology governance. Amidst these shifting forces, the Middle East continues to occupy a unique and commanding position as a locus of policy concern.

At the most recent NPT review conference, States Parties in attendance agreed to several follow-on actions, including the further pursuit of nuclear disarmament as required by Article VI of the treaty.³¹ But beyond debate over the central goal of disarmament, the Review Conference also focused much attention on the emerging nuclear energy renaissance, agreeing to “[u]ndertake to facilitate...the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy,” with a special emphasis on assisting developing states.³² The final document also calls for the strengthening of the International Atomic Energy Agency’s technical cooperation program, and instructs States Parties to discuss further “the development of multilateral approaches to the fuel cycle.”³³ This outcome presents unique opportunities for Middle Eastern governments intent on pursuing expanded civilian nuclear power generation, but who may lack the indigenous expertise and trained workforce to

³⁰ Lewis A. Dunn, *Beyond Nonproliferation: US Policy in a Proliferating World* (Twentieth Century Fund, 1981).

³¹ 2010 Review Conference of the Parties to the Treaty on the Nonproliferation of Nuclear Weapons, “Final Document,” Volume I and II, New York, 2010, p. 20-24.
[http://www.un.org/ga/search/view_doc.asp?symbol=NPT/CONF.2010/50%20\(VOL.I\)](http://www.un.org/ga/search/view_doc.asp?symbol=NPT/CONF.2010/50%20(VOL.I)).

³² 2010 Review Conference, “Final Document,” p. 27.

³³ 2010 Review Conference, “Final Document,” p. 28.

bring these plans to fruition. Balancing nonproliferation obligations with assistance opportunities will be central to the success of energy diversification plans across the region.

Past Review Conferences have also focused on the Middle East as a particular region of interest. At the 1995 Review Conference, when States Parties indefinitely extended the NPT, participants adopted the “Resolution on the Middle East,” which endorsed the creation of a nuclear-weapons-free zone (NWFZ) in the region and calls on all states to accede to the Treaty as non-nuclear weapons states.³⁴ The final document of the 2010 Review Conference reaffirms that earlier Resolution, and explicitly emphasizes “the importance of Israel’s accession to the Treaty and the placement of all its nuclear facilities under comprehensive IAEA safeguards.”³⁵ To take practical steps toward the realization of a Middle East NWFZ, the Review Conference endorsed a meeting to be held in the region in 2012. Additionally, the UN Secretary-General will appoint “a facilitator, with a mandate to support implementation of the 1995 Resolution by conducting consultations with the States of the region in that regard and undertaking preparations for the convening of the 2012 conference.”³⁶ Forward momentum on establishing a NWFZ across the region would undoubtedly go far to reassure regional participants and the international community as a whole of national governments’ commitment to pursuing nuclear technology for peaceful purposes.

The 2010 Review Conference was neither a resounding success nor a failure. By propelling the issue of disarmament back into active consideration, additional nonproliferation and arms control measures may be possible that will help build a fire-break between the expansion of civilian power and nuclear proliferation. A strengthening of the regime could also offer tangible benefits to regional governments seeking to pursue diversification of energy supplies through nuclear power by reassuring technology and know-how “supplier states” with enhanced assurances of their peaceful intent.

THE TECHNOLOGIES

Containing atomic energy and the weaponization of bomb-grade materials through “guards, guns, and gates” has long been understood as an insufficient approach to nuclear dangers. Today’s new and renewed interest in nuclear power brings with it an increased risk of nuclear weapons proliferation due to existing reactor designs and the resulting spread of uranium enrichment technology. As the number of reactors and enrichment facilities increases, so do the opportunities for the production and diversion of bomb-grade materials.

³⁴ 1995 Review and Extension Conference of the Parties to the Treaty on the Nonproliferation of Nuclear Weapons, “Final Document,” Part I, New York, 1995, p. 13-14. http://www.un.org/disarmament/WMD/Nuclear/1995-NPT/1995NPT_OfficialDocs.shtml

³⁵ 2010 Review Conference, “Final Document,” p. 29.

³⁶ 2010 Review Conference, “Final Document,” p. 30.

Several Western governments have sought to persuade states interested in nuclear power to forswear the development of uranium enrichment technology, thus minimizing the number of facilities in which weapons-grade fissile materials can be produced—a clear extension of technology denial. In the Middle East, the United Arab Emirates has recently chosen this path; however, widespread adoption across the region seems unlikely.

Many states that seek to develop a domestic fuel cycle capability do so to ensure that their supply of nuclear fuel will not be disrupted by the political whims of foreign suppliers. Examples abound of nations leveraging their energy resources to extract political concessions from neighbors. The nuclear energy arena is no different, as exemplified by the United States' decision to cancel nuclear fuel supply contracts with Iran after the Iranian Revolution.

Innovative efforts have been developed to reduce enrichment-technology proliferation. To ease concerns about arbitrary supply restrictions, experts have long recommended that existing nuclear supplier states establish so-called **international fuel banks** and develop ownership schemes that would essentially multilateralize the fuel cycle. Fuel banks are confidence-building measures meant to back up the commercial nuclear fuel market. Generally, a fuel bank is a reserve of low-enriched uranium (LEU) that is held in escrow, a form of insurance against the vagaries of the market. Should the open market fail or refuse to provide fuel to a country for political reasons, fuel from the reserve would be released to that country, provided the country meets certain nonproliferation criteria.

- The United States, the United Kingdom, the World Nuclear Association, and the Nuclear Threat Initiative (NTI) have all floated proposals for fuel banks.³⁷
- NTI donated \$50 million to the IAEA towards the construction of a fuel bank housing 60-80 tons of nuclear fuel.³⁸ The donation required the IAEA to find \$100 million in matching funds, and left all policy decisions regarding the fuel bank's operation to the IAEA.³⁹ The Agency reached its donation requirement in March 2009, and Kazakhstan has offered to host the project.⁴⁰

³⁷ Yuri Yudin, *Multilateralization of the Nuclear Fuel Cycle: Assessing the Existing Proposals* (New York: United Nations Institute for Disarmament Research, 2009), p. 17

³⁸ Westall, Sylvia. "Obama-backed nuclear fuel bank plan stalls at IAEA." *Reuters*, June 18, 2009. <http://www.reuters.com/article/idUSTRE55H58L20090618> (accessed July 1, 2010).

³⁹ Horner, Daniel, and Oliver Meier. "Talks on Fuel Bank Stalled at IAEA." *Arms Control Today*, October 2009. http://www.armscontrol.org/act/2009_10/fuelBank (accessed July 1, 2010).

⁴⁰ The European Union, Kuwait, Norway, the United Arab Emirates, and the United States all contributed to the project. Nuclear Threat Initiative. "NTI in Action: Creating an International Nuclear Fuel Bank" http://www.nti.org/b_aboutnti/b7_fuel_bank.html

- Russia offered to host a low-enriched uranium fuel reserve as a part of its International Uranium Enrichment Centre (IUEC) in Angarsk. The reserve would hold 120 metric tons of fuel under IAEA auspices and safeguards.⁴¹ Russia offered to fund the procurement and maintenance of the center, as well as assure export licenses if the bank should be used.

Of these alternatives, the NTI and Russian proposals were both considered at the June 2009 meeting of the Board of Governors, and were met with unexpectedly high resistance from potential recipient states, especially those of the Non-Aligned Movement. Questions included what constituted a “political” cutoff, how and where the LEU would be fabricated into fuel rods, whether non-NPT members would have access to the fuel, and whether the proposals would conflict with their NPT Article IV rights to the full complement of nuclear fuel cycle technologies.⁴² After a great deal of discussion, the Board of Governors approved the Russian plan at its November 2009 meeting and the IAEA signed an agreement for the fuel bank with Russia in March 2010.⁴³

In addition to its role as a fuel repository, IUEC will be a **multinational enrichment facility**. Russia, which first announced the IUEC in 2006, is offering stock ownership of up to 49 percent of the facility. Kazakhstan and Armenia have both bought into the facility, negotiations with Ukraine are pending, and discussions with several other countries have occurred.⁴⁴ Russia has said that the facility will be a “black box,” meaning that countries will have access to the enrichment products, but not to Russian enrichment technology. Russia has pledged to place the facility under IAEA safeguards by mid-2010.⁴⁵

Germany has championed its **Multilateral Enrichment Sanctuary Project (MESP)** to the IAEA in recent years.⁴⁶ The project calls for a host country to cede a portion of its territory to the IAEA, which would then develop an enrichment facility. States could join the venture both to secure a national supply of nuclear fuel and to pursue hoped-for profits. The IAEA would control and manage the enrichment technology. Germany developed detailed protocols for the facility, which

⁴¹ Yudin, “Multilateralization,” p. 18.

⁴² Statement of the G-77 and China during the IAEA Board of Governors, 15–18 June 2009, delivered by Ms. María de los Milagros Donna Raballo, Chargé d’Affaires, Permanent Mission of Argentina. <http://www.g77.org/vienna/IAEAJUNEBOARD09.htm>

⁴³ Sasha Henriques. “Agreement Signed to Set Up a Low Enriched Uranium Reserve.” *IAEA News Centre*, March 29, 2010. <http://www.iaea.org/NewsCenter/News/2010/uraniumfuelbank.html> (accessed July 1, 2010).

⁴⁴ These countries are Belarus, Belgium, Bulgaria, China, Finland, Japan, Kyrgyzstan, Mongolia, Slovakia, South Africa, South Korea, and Uzbekistan.

Anya Loukianova, “Issue Brief: The International Uranium Enrichment Center at Angarsk: A Step Towards Assured Fuel Supply?” *Nuclear Threat Initiative*. October 2007; Updated November 2008. http://www.nti.org/e_research/e3_93.html

⁴⁵ *RIA Novosti*. “Russia, IAEA inked Angarsk fuel bank agreement.” March 29, 2010. http://www.rosatom.ru/en/about/press_centre/news_main/index.php?id4=17778 (accessed July 1, 2010).

⁴⁶ Yudin, “Multilateralization,” p. 46-48.

it submitted to the Board of Governors for review in July 2009. However, the facility's murky territorial status and related questions surrounding potential liability have halted more substantial discussion of the project.

Although the fuel bank idea has garnered much attention, the concept underlying the bank itself has been perceived by some as a mechanism for expanding the technology denial regime. It is no secret that there is an existing technology imbalance in civilian nuclear technology that breaks across North/South lines. More than 80 percent of capacity is in member nations of the OECD while slightly more than 10 percent is in the former Soviet bloc. The remainder, just 5 percent, is found in developing countries including China and India. This particular technology imbalance reinforces the sense across the Non-Nuclear Weapons States community that advanced technology should reside in the "trustworthy" states of the northern hemisphere rather than the proliferation-suspect countries of the global south.

In addition to concerns over the fuel cycle itself, security analysts have pointed to existing **reactor designs** in operation as cause for proliferation concern. In response, supplier states have been working to improve reactor designs to help ensure against the illicit redirection of bomb-grade materials. The Generation IV International Forum (GIF) and the IAEA International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) are developing proliferation-resistant technologies for civilian nuclear power. GIF is comprised of thirteen member states—primarily advanced nuclear nations—while INPRO has thirty members and a wider geographical distribution. Both projects are also working on new reactor designs that are inherently less prone to proliferation. For example, research on breeder reactors that do not require a blanket of weapons-grade plutonium is ongoing, and GIF expects a deployable system between 2020 and 2025.⁴⁷

The **thorium fuel cycle** is yet another promising technology that has enjoyed a renewed interest in recent years because it does not require the large-scale enrichment facilities requisite for the uranium fuel cycle.⁴⁸ Nor is thorium useful in a nuclear weapons program, because it does not permit chain reactions like U-235. However, the thorium cycle does require some reprocessing of spent fuel, opening a potential new pathway for proliferation.⁴⁹ With about six times more thorium than uranium, India has made utilization of thorium for large-scale energy production a major goal in its nuclear power program. But much development work is required before the thorium fuel cycle can be commercialized, and the effort required seems unlikely to be pursued while abundant uranium is available. In this respect, recent international moves to bring India

⁴⁷ Report of the International Commission on Nuclear Nonproliferation and Disarmament (ICNND), "Eliminating Nuclear Threats," Canberra: 2009, p. 127. Generation IV International Forum, "GIF and Generation-IV." http://www.gen-4.org/PDFs/GIF_Overview.pdf

⁴⁸ IAEA. "Thorium Fuel Cycle — Potential Benefits and Challenges." May 2005.

http://www-pub.iaea.org/MTCD/publications/PDF/TE_1450_web.pdf

⁴⁹ Report of the International Commission on Nuclear Nonproliferation and Disarmament. p. 127.

further into the ambit of international trade might result in its ceasing to persist with the thorium cycle, as it now has ready access to traded uranium and conventional reactor designs.⁵⁰

Discontent over this regime imbalance combined with the democratization of technology and the nuclear renaissance itself pose direct challenges to the practicality and verifiability of denial strategies in the twenty-first century. As such, it is clear that neither fuel bank schemes nor proliferation-resistant reactors alone can address the wider proliferation questions emerging from the renaissance.

THE PREVENTIVE STRATEGIES

In April of 2009, in an attempt to bridge the growing division between the “nuclear-haves” and the “nuclear have-nots,” President Obama outlined his vision and plans for a world free of nuclear weapons. For the United States, renewed interest in disarmament is seemingly driven by growing evidence that the al Qaeda terrorist network remains devoted to obtaining and using a nuclear weapon. Around the globe there have been fifteen known cases of theft or diversion of highly enriched uranium or plutonium—the critical ingredients of a nuclear weapon.⁵¹ Preventing what the United States sees as the greatest threat to international security—terrorist acquisition of a nuclear weapon—therefore required not only new assurances that emerging efforts in the civilian power generation space will not yield fresh opportunities for terrorist acquirement, but an expedited effort to lock up or eliminate existing stockpiles of bomb-grade material.

Speaking in Prague, the president announced his plan to host a “Nuclear Security Summit” with the purpose of catalyzing a new international effort to secure all vulnerable nuclear material around the world within four years. The resulting Washington Summit in April 2010 yielded a variety of national pledges including: new national efforts to ratify the 2005 Amendment of the Convention on Physical Protection of Nuclear Materials (Argentina, France, Germany, the United Kingdom), new financial commitments to the IAEA’s Nuclear Security Fund (Belgium, Japan, New Zealand, Norway, Russia) and the hosting of additional international gatherings to discuss next steps on nuclear security (Republic of Korea, Saudi Arabia).⁵²

Implementing a more rigorous array of preventive efforts will be challenging. For instance, attempts to revive negotiations on a fissile material cutoff treaty (FMCT) that would outlaw the production of fissile material for use in nuclear weapons have foundered over enduring concerns about monitoring and verification. Pakistan blocked the 2010 agenda at the Conference on Disarmament by proposing two additional items—conventional arms control at the regional and

⁵⁰ World Nuclear Association. “Thorium.” July 2010. <http://www.world-nuclear.org/info/inf62.html>

⁵¹ International Atomic Energy Agency “Illicit Trafficking Database.” <http://www-ns.iaea.org/security/itdb.htm> (accessed July 1, 2010).

⁵² Office of the Press Secretary, the White House. “Highlights of the National Commitments made at the Nuclear Security Summit.” April 13, 2010. <http://www.whitehouse.gov/the-press-office/highlights-national-commitments-made-nss> (accessed July 1, 2010).

sub-regional level, and a global regime on all missile aspects—thus forcing an adjournment for consultations.⁵³ India is unlikely to accept Pakistan's proposals, thus placing the outcome of the entire conference in doubt and casting an ominous shadow over hopes for progress through 2010.

The failure to create pragmatic progress within formal multilateral fora like the Conference on Disarmament has yielded an array of efforts designed to fill perceived nonproliferation gaps. These efforts were designed both to promote a more rigorous set of nonproliferation activities and to offer governments the financial and technical assistance necessary to meet these elevated standards.

1. THE GLOBAL PARTNERSHIP AGAINST THE SPREAD OF WEAPONS AND MATERIALS OF MASS DESTRUCTION

Launched in 2002 at the G8 Summit in Kananaskis, Canada, the Global Partnership aims to secure and eliminate nuclear, chemical, and biological weapons and related materials. The G8, in conjunction with several other countries, pledged to provide \$20 billion in nonproliferation funding over 10 years. Eight years after the Global Partnership's founding, the United States government has been responsible for three-quarters of all spending under the Global Partnership. Despite the disappointing contribution from some states, the Global Partnership's overall contribution to securing nuclear materials should be a significant factor in meeting world leaders' pledge at the Nuclear Security Summit to secure all nuclear material by 2013. However, just as the global financial crisis has called into question many governments' ability to pursue realistic plans for civilian nuclear power generation, so too has it negatively impacted governments' financial commitment to ad hoc nuclear "threat reduction" strategies. At the 2010 G8 Summit in Muskoka, Canada, leaders failed to renew their contributions to the Global Partnership in the face of growing pressures on national budgets. Failure to renew the Global Partnership could eliminate a significant carrot offered to states whose interests in nonproliferation may directly compete for resources with their economic development opportunities, pursuit of civilian nuclear power options, and other different, but important, national goals.

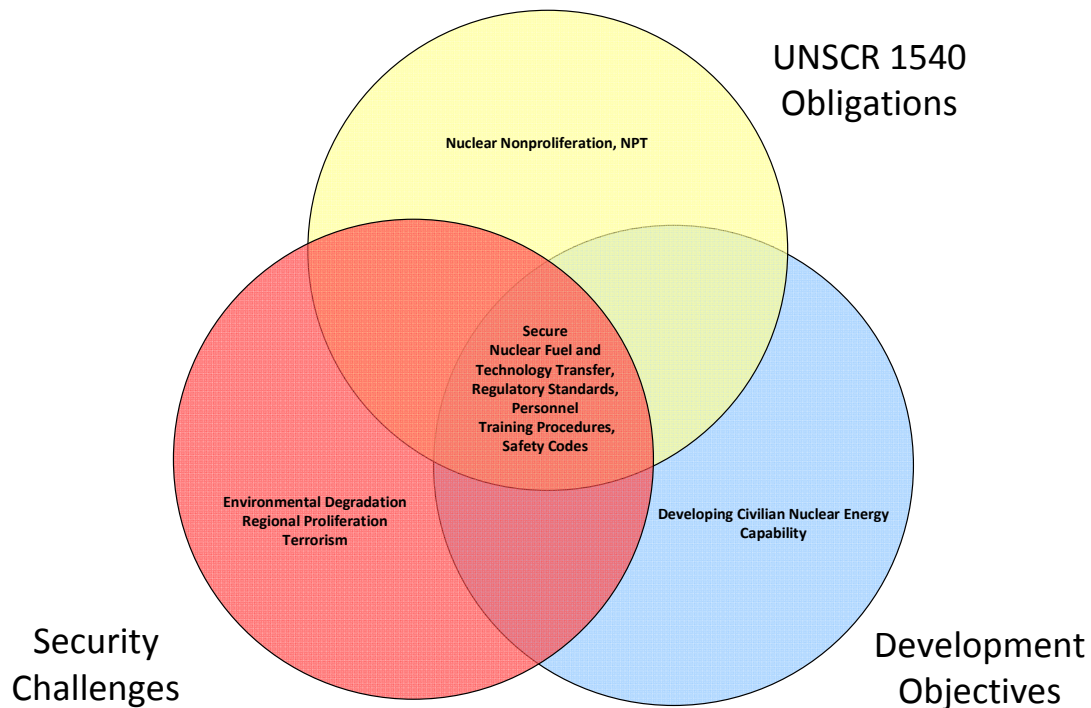
2. UN SECURITY COUNCIL RESOLUTION 1540

In April 2004, the UN Security Council unanimously passed Resolution 1540, which mandates that all Member States implement a set of supply-side controls related to the nonproliferation of nuclear, biological, and chemical weapons, and criminalize proliferant activities within their territories. The significantly elevated standards mandated by the Resolution are proving to be a considerable challenge for governments that lack either the financial or technical wherewithal to meet them. Fortunately, embedded within the Resolution is a provision that encourages those states with the capacity to provide assistance to do so, and requests those states needing assistance

⁵³ Jonathan Lynn, "Pakistan Blocks Agenda at U.N. Disarmament Conference," Reuters. January 19, 2010. <http://www.reuters.com/article/idUSTRE60I26U20100119>

to make such requests. This provision provides a unique opportunity to link the security standards mandated by the global nonproliferation agreements with Middle Eastern and other regional efforts to pursue civilian nuclear power generation.

Figure 3: United Nations Security Council Resolution 1540 Obligations



By leveraging the technical assistance necessary to design, build, and safely operate a civilian nuclear facility through the terms of Resolution 1540, governments of the region could not only expedite plans for energy diversification, they could simultaneously reassure the international community of their peaceful intent. Considered in this way, UN Security Council Resolution 1540, and more broadly, the ad hoc proliferation prevention regime, could be leveraged not as an obstacle to the development of civilian nuclear power development, but as a mutually beneficial instrument fills capacity shortfalls while ensuring that international nonproliferation obligations are satisfied.

CONCLUSIONS

The workshop provided a useful venue for a pooling of knowledge and strategic thinking related to the nuclear energy renaissance, the state of play of nuclear energy discourse in the Gulf region, and the many global initiatives related to nuclear nonproliferation and disarmament. It was intended as an opportunity to bring together two distinct communities – nuclear energy experts and nuclear weapons and nonproliferation experts – to share information and to familiarize both communities with ongoing research, policy analysis, and major international events. It is hoped that the collaboration between the Stimson Center, the Faisal Centre, and the Institute of Diplomatic Studies can continue on these and other highly consequential topics in the future.

Based in Washington, DC, the Stimson Center is a nonprofit, nonpartisan think tank dedicated to developing new knowledge and crafting "pragmatic steps for global security." Stimson works on a wide range of global security issues, from nonproliferation to regional security in Asia, from UN peacekeeping operations to analyzing the resources needed for 21st century statecraft.

The King Faisal Center for Research and Islamic Studies was established in 1983 as an operational arm of the King Faisal Foundation, in the field of research and studies.

The Center set its objectives as follows:

- Support research on current and contemporary issues affecting the Islamic world.
- Enhance dialogue, understanding, and collaboration among civilizations and nations.
- Training a new generation of specialized scholars in the field of Islamic studies, Arabic language, and social sciences.
- Collecting information and data and the creation of specialized databases for researchers that translate a variety of foreign works into Arabic.
- In conformity with its objectives, the Center has focused since its inception on promoting research activities, conferences, lectures, and publications, related to periods of early and modern Islamic civilization and history.

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