New Nuclear Suppliers

Encouraging Responsible Nuclear Supply by China, Republic of Korea, and India

REPORT OF WORKSHOPS HOSTED BY THE
CSIS PROLIFERATION PREVENTION PROGRAM

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New Nuclear Suppliers: Cultivating Responsible Nuclear Supply

Nuclear energy seemed set for revitalization until the accident at the Fukushima Daiichi nuclear power plant in 2011. The accident that melted the cores of three light water reactors raised questions about the costs and risks of nuclear energy in many countries. Some countries have cancelled procurement, others have shut down reactors, and still others have declared a shift away from a nuclear future.

But the story is not yet over. Many countries still face the trends that made nuclear power attractive in the first place: high population growth, accelerating electricity demand and climate change. This is true particularly across Asia. For countries in Northeast, Southeast and South Asia, nuclear power plant construction may proceed more slowly than initially planned, but is likely to move forward.

The nuclear energy landscape will shift significantly over the next few decades as less developed economies in regions that are new to nuclear power build up capacity and existing nuclear capacity recedes in importance or dwindles in North America and Western Europe. Nuclear suppliers that have dominated supply for many years may not be able to compete with newer suppliers who are building at home and may be eager to export. The biggest nuclear energy producers (United States, France and Japan) all have nuclear industries suffering under significant financial stress, with limited prospects for export. Russia has been able to offer attractive contracts to new buyers and so has South Korea, at least in its deal with the United Arab Emirates.

A shift in the buyers for nuclear energy from the predominantly developed economies to less-developed economies could mean a long-term shift in nuclear supply. Some industry analysts have suggested that the key to bringing down construction costs may lie in Indian and Chinese nuclear supply. Given a distinctly different competitive landscape, how can suppliers cultivate the kind of responsibility that is urgently needed to improve nuclear governance globally so that nuclear energy can be safe, secure, and reduce the risks of nuclear weapons proliferation?

The CSIS New Nuclear Suppliers project, with funding from the MacArthur Foundation, sought to initiate a dialogue with emerging nuclear suppliers on the contours of "responsible nuclear supply." With co-hosts in Delhi, Seoul and Beijing, the project convened workshops on responsible nuclear supply that included experts from industry, government, and civil society. Participants discussed how to define "responsible nuclear supply" (e.g., supply that minimizes or does not increase the risks of radiation release to the environment, people, or society) and measures that could be taken by vendors, by governments and by groups of countries acting loosely in concert, or in multilateral groups like the Nuclear Suppliers Group (NSG).

POTENTIAL NEW SUPPLIERS

China, Russia, India and South Korea lead the pack in nuclear power plant construction, with China accounting for more than a third of the nuclear power reactors currently being built worldwide. Growth in nuclear capacities in China, India, and South Korea has created both opportunities and challenges for the global nuclear regime.

China

China has the fastest growing nuclear industry in the world, with 17 units in operation and 30 under construction. Another 35 coastal plants are planned but the development of 24 inland plants has been deferred. So far, China has exported power reactors only to Pakistan, and has no obvious national vision for exporting reactors, but there are a few signs of future interest: China's State Nuclear Power Technology Corporation has formed a joint venture with Westinghouse to market Westinghouse-based reactors, and along with China General Nuclear Corp (CGNC) and China National Nuclear Corp (CNNC), pitched Chinese reactors to South Africa earlier this year. Last year, China signed a nuclear cooperation agreement with Saudi Arabia. This year, CGNC and CNNC partnered with EDF in a $25 billion deal to build nuclear power plants in the United Kingdom. Although Chinese involvement in the UK deal seems to be limited to financing, future export efforts will need to balance resources devoted to China's considerable domestic nuclear power development and export opportunities.

China is a relative newcomer to nuclear power; its first nuclear power plant began operation in 1993. It has moved quickly to indigenize nuclear technology, but the majority of the Chinese plants under construction now incorporate Generation II technology. After Fukushima, some observers suggested that China should shift focus to Generation III+ designs because of their greater reliance on passive safety features. At a mini-

Workshop participants discuss the challenges facing China's nuclear industry.

Sharon Squassoni discusses the concept of "responsible nuclear supply" at the workshop held in Beijing, China.

mum, the accident at Fukushima slowed the pace of new construction. China's State Council ordered safety reviews at all nuclear facilities, decided to strengthen the safety management of operational facilities, ordered comprehensive reviews of all nuclear facilities under construction, and suspended the approval of new nuclear projects. Safety reviews that were completed by the end of 2011 concluded that all operating nuclear power plants and those under construction met appropriate standards.

In October 2012, the State Council revised its projections of Chinese nuclear capacity. Instead of 70 GWe by 2020, the new target is 58 GWe, with 30 GWe under construction. Inland nuclear power plant construction has been suspended until 2015, and all new nuclear power plants must have Generation III safety standards.

China has gradually implemented nonproliferation controls. Its nuclear export policy is guided by three principles: technology and equipment should be used for peaceful uses only, should be under appropriate IAEA safeguards and should not be transferred to third party-countries without Chinese consent. China maintains lists of controlled items that are identical to the Zangger Committee and NSG guidelines and has agreed not to export nuclear technology to countries that have been embargoed by the United Nations Security Council. Over the years, China has enhanced its export controls, both externally and internally, by joining the Zangger Committee in 1997, signing the IAEA Additional Protocol in 1998, and joining the Nuclear Suppliers Group (NSG) in 2004. It has signed the Container Security Initiative with the United States and the Joint Declaration on Nonproliferation and Arms Control with the European Union, but has not joined the Proliferation Security Initiative. China has also established an Export Licensing Catalogue of Sensitive Items and Technologies, and it still maintains control for dual-use items that are not on its control lists. Finally, it provides a number of training and consultation programs to ensure that officials responsible for executing export control policy are properly prepared.

South Korea

South Korea has the second most ambitious nuclear power program in Asia, which dates back further than China's to the late 1970s. South Korea also embarked on a path of indigenous production of foreign nuclear power plant design; about half of its operating 23 power reactors were supplied by foreign firms and the other half were built by domestic industry. South Korea is now marketing its own design, the APR1400, which still contains a few Westinghouse components. Korea Hydro and Nuclear Power (KHNP) operates all of South Korea's nuclear power reactors.

In the aftermath of Fukushima, South Korea created the Nuclear Safety and Security Commission (NSSC) as an independent regulatory agency. South Korea adopted a phased safety response plan, which includes special safety inspections of all nuclear facilities, creation of a plan to respond to issues raised during inspections and the lessons from Fukushima, and appropriate amendments to regulations or standards. After the inauguration of President Park Geun–hye in 2013, the independence of the NSSC was somewhat diminished by moving it under the auspices of a new Ministry of Science, ICT and Future Planning that has nuclear energy promotion as a mandate.

At the same time, revelations in 2013 of falsification of safety certificates has shut down some nuclear power reactors and damaged the credibility of South Korea's nuclear industry. Indictments on corruption charges have been handed out to 100 people, and three of South Korea's reactors have been taken offline. Financially, the scandal has been estimated to have cost close to $2.8 billion and could have implications for South Korea's ambitious export plans.

Since 2010, South Korea set a goal of exporting 80 nuclear power plants by 2030, aiming to capture 20% of the export market. Whether potential recipients are concerned about safety and quality issues in Korea's supply issue may be beside the point: export goals are unlikely to be met simply because Korea may not have the human resources to build nuclear power plants at home and export abroad. For example, KEPCO's deal with the UAE for four APR-1400 reactors is already projected to draw 11,000 personnel by 2015, competing with the demand for workers from domestic projects. The current workforce is aging and retiring, and the next generation is significantly less interested in pursuing careers in nuclear power, according to Korean nuclear industry experts. Programs to train workers on the job are useful and necessary, but a different approach may be needed to attract new talent to the field itself.

India

India currently operates 21 nuclear power reactors, most of them of indigenous design. With the exception of light water reactors built by Russia at Kudankulam and by the United States at Tarapur, India's reactors are pressurized heavy water reactors (PHWR). Most of them were designed to have around 200 MWe capacity. However,

A roundtable discussion on South Korea's export capacity, part of the workshop held at the Asan Institute for Policy Studies in Seoul, Republic of Korea.

several have been upgraded to 540 MWe, and India is currently building 700 MWe reactors. India is also developing an advanced heavy water reactor with thorium fuel.

The potential for India to export reactor technology is untested and participants at the workshop discussed particular challenges and opportunities. On the one hand, India has fifty years of experience in nuclear operations and India already exports nuclear equipment. For example, Larsen & Toubro supplies dry storage equipment that meets Nuclear Quality Assurance-1 standards and has received orders for manufacturing large, heavy-walled metal storage casks. India is well-placed to export plant components, materials, equipment, and expertise.

On the other hand, India is no longer building the smaller reactors with which it has the most experience. And NPCIL, the public sector enterprise responsible for designing, constructing, commissioning and operating India's nuclear power plants, may face other obstacles in the global nuclear market. In India, it has not been held liable for delays and cost overruns, which will surely be a factor in competitiveness. A shortage in human resources and adequate industrial capacity more broadly could constrain India's ability to export reactors, although domestic industry capacity could expand as a result of foreign projects in India.

Workshop participants pointed to positive signs from the Indian government on nuclear nonproliferation since the 2008 exemption the NSG granted for trade with non-NPT states. For example, the Indian government supports creating a multilateral fuel cycle and has stated it will not supply enrichment and reprocessing technology to countries that do not already have access to the technology, which is a tougher standard than the NSG requires. Exporting PHWRs or fast breeder reactors, on the other hand, could increase proliferation risks globally.

MOVING FORWARD

Long-term sustainability of nuclear energy will require improved nuclear safety and security and approaches to the fuel cycle that limit growth in weapons-usable nuclear material. Reducing risks from the fuel cycle will need to focus not just on the front end (that is, uranium enrichment), but also use incentives from the back-end (disposal of nuclear waste) to encourage states to avoid acquiring sensitive nuclear technologies like enrichment and reprocessing. This cannot be done by a single country or a single vendor but will require a broad-based collaborative effort.

For vendors, adopting codes of conduct could be helpful (e.g., Nuclear Power Plant Exporters' Principles of Conduct). Sharing corporate risk assessments with a national government could also help inform government officials engaged in negotiating nuclear cooperation agreements as well as export licensing procedures. Self-regulation to improve compliance beyond legal requirements may be attractive to vendors suffering from negative press about faulty components or diverted exports. At the top, encouraging sub-suppliers to adopt similar policies can widen compliance.

At the government level, transparency about export licensing and terms of nuclear cooperation agreements, particularly between governments, could be another element in a framework of responsible nuclear supply. Some of this is done already in the Nuclear Suppliers Group, but some is not. And although the NSG has not been able to agree on making an Additional Protocol a condition of supply, some suppliers require it. In the absence of NSG agreement, suppliers could slowly develop the norm of requiring the Additional Protocol. Another area for discussion would be consent rights for enrichment and reprocessing. Greater uniformity among supplier conditions could help support broader nonproliferation objectives.

Lydia Powell of the Observer Research Foundation speaks at the workshop held in New Delhi, India.

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