



In Historic Russia - China Nuclear Power Cooperation, U.S. Loses Big

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The record-setting nuclear deal inked between China and Russia earlier this month is the latest blow to America's declining influence in commercial nuclear power across the globe.

The deal envisions the construction of four third-generation (Gen 3+) VVER-1200 reactors designed by Russia's Rosatom Corp., along with the supply of generator parts for China's ambitious lunar program and the joint development of an advanced CFR600 "fast breeder" reactor. In total, the contract could reach over 100 billion yuan (\$15 billion) in construction costs, making it the largest bilateral nuclear deal ever signed between the two countries. The value of the initial set of contracts is estimated to be between \$3 and \$5 billion.

Following its rollback of a multiyear freeze on reactor construction, the ruling Communist Party of China (CCP) has made clear its intent to pursue nuclear power as a central component of its energy mix. China already possesses a robust nuclear power supply chain, thanks in part to its willingness to adopt and adapt Western technology.

With the help of Westinghouse, Rosatom, and France's Areva, China now boasts the ability to design and construct its own 3+ generation reactor – the Hualong One – a cheap but effective alternative to Western competitors. It speaks volumes that, despite its new indigenous capability, China's National Nuclear Corporation (CNNC) is still purchasing Russian designed units like the VVER.

For its part, Rosatom, which is already building more latest generation reactors across the world than all its competitors combined, is happy to cash in on the world's most lucrative market for nuclear power vendors. Nuclear is a primary high-tech Russian export to China beyond weapons systems and commodities, and a number of VVER units are already in operation across the PRC. Two of the proposed VVER-1200's in this most recent deal will become units 7 and 8 of the Tianwan Nuclear plant in Jiangsu province, where three VVERs are already running (with one scheduled to be completed before 2019).

Part of the Russian appeal globally is their all-inclusive package offers for new nuclear plants—financing the cost of reactor construction, employee training, facility operation, and even spent fuel management. Yet, it's not what works for China, which is one of the very few countries in the world capable of paying cash to foreign nuclear vendors and eager to develop its own nuclear energy and heavy industries.

As with previous VVERs, Chinese companies would carry out construction works and take care of the manufacturing for all auxiliary components and systems, while the Russians would supply the reactors themselves.

It appears that China, having acquired the latest Western nuclear technologies, is now after the most advanced Russian ones. It may well also be exploring new export supply chain opportunities globally as VVERs have managed to become the most common new build design in the world.

What is concerning is that the Russian Federation's burgeoning nuclear relationship with China fills the void left by the unfulfilled promise of the Western nuclear renaissance.

Per the deal, two of Rosatom's 1,200 megawatt (MW) reactors are slated for construction on the greenfield site of Xudabao, northeastern China, the very same location where six 1000 MW Westinghouse AP1000 units were planned.

Back in 2007 China agreed to build four AP1000 reactors, with the first coming online as early as in 2014. The construction then was beset by safety concerns, design changes, years of delays and billions of cost overruns. There are now hopes that the first AP1000 unit will be completed by the end of 2018. Back home similar delays and cost overruns triggered Westinghouse's bankruptcy.

It remains unclear whether the Russian VVER-1200s will supplant the AP1000s or operate alongside them, but in either case the US global reputation as a leader in nuclear energy stands to lose. America's nuclear sector is ceding its competitive edge in a global industry that is expected to grow significantly in the coming years.

With developing economies like China and India embracing nuclear power as a means to simultaneously address growing energy demand and improve air quality, civilian nuclear capacity additions will continue to increase worldwide. The Department of Commerce predicts that the global demand for nuclear energy technology will total \$500-\$740 billion over the next decade. A projected \$3 trillion worth of nuclear power plants will be purchased between now and 2050, according to the International Energy Agency (EIA), with international nuclear capacity doubling in that timeframe.

The United States civilian nuclear sector, however, is ill-prepared to reap the rewards of this global nuclear power renaissance. Aside from 2013 when the construction of four Westinghouse AP1000 reactors began along the Georgia-South Carolina border, the last nuclear reactor project in the United States was 1977. A host of challenges have hamstrung power plant constructors in the intervening period: more stringent safety regulatory requirements in the wake of nuclear accidents at Three Mile Island, Chernobyl, and Fukushima; lack of political support; rising input costs; electricity market liberalization; and competition from other power sources – primarily wind and natural gas.

Perhaps the single largest obstacle to America's nuclear power competitiveness is the de facto requirement that power generation be financed privately. Due to the enormous upfront capital costs of nuclear power plants, their competitiveness is vulnerable to the vagaries of energy prices. When energy prices are depressed, as has generally been the case since late 2014, lenders demand higher interest rates for large projects, meaning that operators must then charge more per kilowatt hour (kWh) to meet their debt obligations. This in turn makes them less competitive.

With shrinking margins at home, America's private nuclear operators are at a significant disadvantage to the state-owned providers in Russia and China. Because the likes of Rosatom and CNCC serve the goals of their governments' energy diplomacy strategies, they enjoy tremendous financial and political support regardless of market conditions. State owned enterprises (SOEs) are therefore insulated from energy market boom-bust cycles. Furthermore, China and Russia are able to offer more attractive financing terms to potential clients than their Western counterparts, as they are not bound by OECD export credit regulations. This confluence of factors leaves the competitive advantage to China and Russia's state-backed nuclear operators.

From a manpower perspective, the United States is also falling behind. According to the Bureau of Labor Statistics, nuclear engineers were among the STEM (science technology engineering and mathematics) occupations with the highest employment losses between 2012 – 2016, shedding 2,250 jobs in that timeframe. Growth in the profession is near -4 percent. In China, where 20 new projects are under construction and cutting edge "fast reactor" concepts are being piloted, the government has fostered an ideal environment for prospective nuclear engineers. To illustrate this widening gulf, Westinghouse actually recruits Chinese engineers to support their sites in the United States.

Together CNCC and Rosatom have a slew of nuclear projects planned across the globe. Russia has agreements in place with India, Bangladesh, Egypt, Jordan, Finland, Belarus, Hungary and Turkey. For its part, China is active in Algeria, Ghana, Pakistan, Saudi Arabia, and the United Kingdom. The aforementioned represent lost opportunities for Westinghouse and other Western civilian nuclear companies. American influence in these countries is yet another casualty.

U.S. exports of nuclear technology are also hampered by political considerations as well as a heightened sensitivity to proliferation risk. While the Chinese and Russian governments do choose their customers carefully – neither would endorse a project if a host country fails to meet security and safety guarantees for its plants and workers (many of whom are their own citizens) – they are less discerning than the United States. Multiple regulatory bodies must approve the imports and exports of nuclear materials and services in the U.S. – most notably the Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE). Nuclear equipment, including reactors, fuel cycle facilities and nuclear materials are controlled by the former, whereas technological and technical assistance and services are administered by the latter. The Department of Commerce oversees export of 'dual use' items under Export Administration Regulations. Comparable regulatory bodies and restrictions either do not exist or are much less robust in China and Russia.

The political circumstances of a potential nuclear power customer must also be considered. CNCC and Rosatom exist as defacto arms of foreign policy for their respective state governments. Both are more likely to overlook issues such as oppressive regimes and human rights abuses – deal-breakers for U.S. exporter regulators – if it means the advancement of certain policy objectives. It goes beyond the scope of this paper to determine which potential nations-state buyers are worthy of nuclear power technology, but it is clear that lower standards for Russian and Chinese companies add yet another competitive hurdle for the United States.

Washington must make advanced nuclear power commercialization a key priority to keep domestic nuclear exporters competitive. Short of directly financing projects as their Russian and Chinese competitors do, the U.S. government can increase funding for research and development. Each dollar spent on nuclear R&D – \$707 million for the Office of Nuclear Energy (NE) in 2017 – contributes to efficiency gains, innovation, and overall improvements which help the United States compete on the global stage. NE has requested an additional \$50 million for fiscal year 2019 citing budget deficiencies for advanced nuclear technology testing. The administration should honor this request.

Improved financing tools for civilian nuclear exporters is also crucial. While Russia and China enjoy virtually endless public funding support, American exporters have little more than a broken Export-Import Bank. Currently missing 3 of 5 seats, the board of the bank is unable to reach a quorum on lending decisions, and therefore projects are limited to \$10 million each – an insignificant amount for multi-billion-dollar greenfield energy projects. Aside from fixing this glaring issue (done through Senate nominee confirmation), the current administration must establish additional means for providing financing guarantees to our nuclear vendors wishing to do business overseas. This could include creative use of OPIC and USAID funding, as well as defining nuclear as a "clean energy source" to ensure eligibility of various funding mechanisms.

Finally, Washington can leverage its position within the OECD. Policy makers should push for the relaxation of OECD export credit regulations, which would have a significant and immediate impact on U.S. nuclear exports. Alternatively, the United States should partner with its fellow OECD members – many of whom are nuclear exporters as well – to pressure Russia and China to fall in line with OECD trade standards moving forward.

Capturing just a fraction of this profitable market would be a windfall for the U.S. economy. It would also provide a much-needed soft power boost across the globe and place more nuclear power hopefuls under the careful eye of U.S. non-proliferation standards. The opportunity cost is too great, and the dangers too real, for anything less.

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