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Roadblocks for US Nuclear Exports



US nuclear power companies face roadblocks in the export market. Without US government actions to resolve commercial and non-proliferation issues, US nuclear companies will have a hard time competing in today's global nuclear market against state-owned nuclear companies from Russia, China, and other countries.



The biggest opportunity for the global nuclear power industry today is Saudi Arabia. Originally Saudi Arabia planned a fleet of sixteen or more reactors to help it meet growing demand for electricity, to help shift to a cleaner post-petroleum electricity system, and to add skilled jobs to the Saudi economy. Now, they have scaled down their nuclear power program to a few plants. The supplier of the first few Saudi nuclear power plants (NPPs) will be in a strong position to build the larger nuclear fleet that Riyadh is likely to build.

Five nuclear power vendors are competing for the nuclear power sale to Saudi Arabia, with Westinghouse facing off against nuclear state-owned enterprises (SOEs) from Russia, China, France, and South Korea.

A few decades ago, the US was the world leader in nuclear power technology and was able to succeed in the export market on the basis of its large domestic nuclear power fleet and a proven nuclear industrial capability. Today, the US nuclear power industry is trying to sell nuclear power plants (NPPs) in the export market in order to sustain US domestic nuclear industrial capability and to position itself for future nuclear export opportunities.

The US nuclear power industry is a collection of private, shareholder-owned companies that faces two primary roadblocks in the nuclear power export market:

- The US commercial nuclear power industry has difficulty matching the attractive commercial offers from the nuclear SOEs; and
- The restrictive US approach to non-proliferation may limit nuclear power exports, compared to other countries with less stringent requirements.

Commercial Issues

New reactor designs from US companies are excellent, but not inherently best-in-class, compared to reactor designs offered by competing nuclear SOEs.

In contrast to the American commercial market-driven approach to the nuclear power industry and to nuclear power exports, nuclear SOEs in [China](#), [Russia](#), and other countries see nuclear power as a part of larger government-to-government (G2G) relationships. In addition to financing/funding for nuclear power projects through G2G loans, SOE nuclear export offers are thought to include favorable pricing and acceptance of completion risk.

These nuclear SOEs use the nuclear build programs inside their countries to support their nuclear power exports. Using a combination of state-owned nuclear industrial champions and state-owned electric utilities, these nuclear SOEs develop and build new domestic NPPs. The domestic nuclear fleet build enables the nuclear SOEs to gain nuclear industry experience, demonstrate their own reactor designs, and develop a proven nuclear power supply chain – all of which support nuclear power exports. These nuclear SOEs are in the export market to earn hard currency, to import jobs for their domestic nuclear industrial companies, to establish long-term nuclear plant services and fuel customers, and to support broader geopolitical objectives.

China and Russia have recently expanded the powers of their nuclear SOEs, widening the gap between the capabilities and market offerings of these enterprises and the private US nuclear power industry.

In Russia, the vertically-integrated nuclear company, Rosatom, is a key player in [domestic](#) and foreign energy policy that aims to preserve and strengthen Russia's global market share and influence. Russia's ongoing and planned projects include: [Bangladesh](#), [Belarus](#), [China](#), [Egypt](#), [Finland](#), [Hungary](#), [India](#), [Iran](#), [Turkey](#), and [Uzbekistan](#).

Russian investments are aimed at completing the first [floating NPP](#), [expanding its nuclear-powered icebreaker fleet](#), growing its presence in [global nuclear fuel markets](#), and engaging in [several advanced reactor projects](#).

China is a relative newcomer to the nuclear power industry, but it has consolidated its nuclear enterprise through state financing for energy sector infrastructure and its Belt and Road Initiative (BRI) strategy both at [home](#) and abroad. [China](#) has [grand export plans](#) for nuclear power that are built on [exports to Pakistan](#), a deal with [Argentina](#), multiple initiatives in [the United Kingdom](#), and a place on the [Saudi Arabia nuclear vendor short list](#).

Chinese investments are focused on its rapidly growing domestic nuclear power fleet, [several planned advanced reactor projects](#), developing [floating NPPs](#) and [nuclear-powered icebreakers](#), and ambitions for a [nuclear-powered aircraft carrier](#).

Both countries are seeking nuclear power footholds in other countries in Europe, Eurasia, Africa, and South America.

[A February 2019 meeting between President Donald Trump and US commercial nuclear industry players highlighted several messages](#), including arguments that the US domestic nuclear power industry needs support from the federal government, that commercial US nuclear power industry needs government assistance in the export market, and that advanced reactor technology is a way for the US to regain nuclear industrial leadership.

In order to compete in the nuclear power export market against nuclear SOEs, the US must develop and implement a national nuclear power strategy that supports the domestic nuclear power industry (e.g., existing and new NPP projects), nuclear technology innovation (e.g., advanced reactors), and nuclear exports.

The US domestic nuclear power fleet, still the largest in the world, may no longer support US nuclear companies in the export market. The credibility of the US nuclear power industry in the export market is diminished by the lack of new domestic NPP projects in the US, in contrast to Russia and China which are continuing to build and demonstrate nuclear capacity at home. The track record on the few new US nuclear power projects, including [Vogtle cost and schedule issues](#) and the [abandonment of V.C. Summer](#), is less than stellar. These issues, combined with



the early retirement of existing US NPPs, present reputational risks for the US nuclear power industry.

US nuclear industry companies competing in the nuclear power export market do not have access to the sort of government-sponsored financing used by nuclear SOEs, making it nearly impossible to level the playing field with Russia and China. The level of support that might be offered through OPIC, or the new [US Development Finance Corporation \(USDFC\)](#), falls short of what nuclear SOEs can offer.

While advanced reactor technology research and development is being pursued in the US and in other countries, a new advanced reactor concept will only be a viable commercial power plant option after the concept is used in an actual power plant project. An advanced reactor demonstration project could demonstrate that the advanced reactor concept is valid, that the new advanced reactor design has added value compared to earlier reactor designs (e.g., higher safety, lower cost, flexible operation, and other metrics), and that the new reactor designs can be the basis for a viable commercial power generation investment option.

Unfortunately, prospects are dim for any new nuclear power plant in the US, much less a first-of-a-kind advanced reactor project that layers technology risk on top of nuclear power project risks and costs. Washington could help move these advanced reactor concepts into commercial reality by taking a page from the nuclear SOEs to fund and build one or more advanced reactor power plant projects in the US. Such projects in the US would be a strong advertisement for sales of the new advanced reactor design in the export market.

A comparison to US natural gas exports is apt. While American natural gas exports are not state sponsored and the success in the world natural gas market is largely due to private companies (e.g., by developing disruptive extraction techniques and investing in liquification facilities), the US government's willingness to actively champion natural gas exports for economic and geopolitical purposes should not be discounted. Nuclear power needs at least the same level of engagement on domestic activity and export promotion as the natural gas industry.

The US government should take actions to support and maintain the US commercial nuclear power industry. This should include resolving issues in the US domestic nuclear power industry to avoid the economic retirement of additional existing NPPs with decades of useful life remaining, supporting new US NPP projects that use existing reactor designs, and supporting US demonstration projects using new advanced reactor designs.

The US government should also take actions to assist US commercial nuclear power companies compete in the nuclear power export market. US NPP exports, along with goods and services, create a long-term political relationship over an NPP operating life of sixty years or longer.

Proliferation Issues

In addition to resolving the commercial issues, the US needs to rethink its approach to exporting nuclear power technology, fuel, and services, which is linked closely to imposing [a US view of nonproliferation](#).

The [US approach to non-proliferation](#) conditions exports with bilaterally-mandated nonproliferation agreements that may restrict uranium enrichment activity and other activity.

A few decades ago, when the US was the world leader in nuclear power technology, it used nuclear technology exports [to promulgate its view of non-proliferation](#) by exporting nuclear power technology only to countries that agreed to sign a bilateral treaty (i.e., a 123 agreement). Some countries (e.g., the UAE) were asked to sign a 123 agreement that limited the purchasing country's activity in uranium enrichment and spent fuel reprocessing, both of which might be used to develop a nuclear weapons program. This was referred to as the [Gold Standard](#) for 123 agreements. The US could limit the potential pathway to nuclear weapons for signing countries, and US companies could sell nuclear technology, fuel, and services to the signing countries. However, US nuclear non-proliferation standards may be at odds with increased global competition in the nuclear power industry from countries that may not require these restrictions.

Increased insistence in the US for a Gold Standard Section 123 agreement with Saudi Arabia, that entirely prohibits enrichment and reprocessing of nuclear fuel, as opposed to a standard 123 agreement that only applies to enrichment and reprocessing with US nuclear technology, may limit success in the nuclear power export market. In contrast, Russia and China do not impose the same requirements on existing and planned nuclear power plant sales.

he US view of proliferation implicitly assumes that new nuclear countries should or must rely on global markets and imported nuclear fuel, rather than developing a complete nuclear fuel cycle of their own. In an ideal world, relying on imported nuclear fuel and global markets may be feasible. However, this may add a significant risk to a very large NPP investment (i.e., no nuclear fuel means no power generation, which nullifies the asset value, and may result in electricity grid failures).

However, new nuclear countries are reluctant to give up uranium enrichment because of their need for nuclear fuel security. A country considering a new NPP program will have legitimate concerns about nuclear fuel security and the availability of nuclear fuel over the life of the country's NPPs. In addition to commercial concerns, these countries will also have national infrastructure concerns. A comprehensive nuclear fuel security assessment will consider options to establish a capability to produce nuclear fuel (i.e., including uranium enrichment) inside the country.

US nuclear fuel security has largely been relegated to the utility owners of NPPs, which view this as a commercial issue to be addressed through nuclear fuel procurement strategies. However, even the US has concerns about nuclear fuel security as the [nuclear fuel capability](#) has atrophied. Most (i.e., about 95%) of the uranium used in US nuclear fuel is imported and the 2018 [Section 232 investigation into uranium imports](#) is focused on US national security issues arising from this reliance on uranium imports. The US no longer has operating uranium conversion capability, after the only remaining conversion facility, the Honeywell Metropolis facility, [stopped operation](#) in 2017. The only US uranium enrichment capacity is the foreign-owned [Urenco facility](#) in New Mexico that uses non-US enrichment technology. A 2019 US DOE [HALEU Demonstration Project](#) will restore some US-origin enrichment capacity.



Reducing or removing nuclear fuel security concerns in countries looking to buy NPPs will help convince these countries to reconsider the need for indigenous uranium enrichment capability. With this in mind, the US should craft a new approach to nuclear fuel security that is linked to NPP exports and Washington's stringent nonproliferation conditions should evolve to address legitimate nuclear fuel security considerations.

Conclusions

Having nuclear power [brings countries into a special club](#), with benefits of nuclear power including energy diversification, energy independence, and clean and reliable baseload electricity generation. Foreign nuclear plant buyers may want American nuclear power technology and a deeper relationship with the US, but they are hard-pressed to reject more attractive commercial deals from SOE nuclear vendors that do not require purchasing countries to restrict activity in uranium enrichment.

Without US government action to resolve both commercial and nonproliferation issues, the long-term foreign and security policy dividends that accompany nuclear power exports will be ceded to American competitors. In the meantime, China and Russia's nuclear SOEs provide them a key advantage in an age of increased great power competition.

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