

Asia to lead the shift to nuclear power

[Edward Kee](#), Vice President at [NERA Economic Consulting](#) in Washington, DC, speaks exclusively to Energy IQ's Bryan Camoens on the impact China and South Korea will have on the global nuclear industry. Kee also touches on the nuclear sector in Asia and the future of nuclear energy worldwide. This Interview was done in connection with [Nuclear Energy Asia 2010](#) - Dec 7-8 in Hong Kong.

Camoens: **What is the competitive global position of nuclear power plant designs and vendors?**

Kee: The most important issue for reactor designs is to get a lot of units built and into operation as fast as possible. This gets the design down the learning curve to lower costs and shorten schedules, but also stimulates additional sales from buyers who look for low risk and demonstrated success. While design features are important, market success is much more important.

The Westinghouse/Toshiba AP1000 is the market leader. This design has multiple units under construction in China, with many more planned. It is also the dominant reactor design for new nuclear in the US market, with an approved NRC Design Certification that is being updated. This design is also offered worldwide.

Other designs, including the Chinese CPR1000 and the Russian VVER, have a lot of units built and planned. However, these designs are not competing in the world market in the same way as the AP1000. The CPR1000 is only being built in China (for now) and the VVER designs are not competing in some key markets, including the USA.

The Japanese ABWR design (now offered by GE/Hitachi and by Toshiba) has multiple units built and planned in Japan and Taiwan, but this design has not been very successful outside Japan. One plant is in the US first wave (the South Texas Project), but is more than a year away from actually starting construction and faces some significant challenges as one of the world's first merchant nuclear plants (i.e., selling its output into the deregulated Texan ERCOT electricity market).

The Korean APR1400 design is well underway in South Korea and has a recent large sale in the UAE.

The French EPR design is well back in the league tables. Despite having the first Generation III unit start construction (in Finland), EPR has yet to win the level of international orders that it hoped for. Another EPR is under construction in France (Flamanville) and two are under construction in China. The Areva plan for multiple units in the US market seems to have resulted in only one potential first-wave project, the Unistar Calvert Cliffs 3 project.

Calvert Cliffs 3, like the South Texas Project, is a merchant nuclear plant that faces significant commercial/financial hurdles; it will be located in the PJM electricity market in the US mid-Atlantic region. Areva has a growing portfolio of potential EPR projects around the world, but none of these seem to have near-term sales.

The APWR design from Mitsubishi is also struggling to get traction, with three units planned in Japan and two second-wave projects in the US.

GE's ESBWR design seems unable to get a single sale, despite some attractive reactor design features (e.g., passive safety, fewer moving parts).

Camoens: How will China's large new nuclear build program impact the global industry?

Kee: China's large build program and their selection of the AP1000 design have already had a large impact on the global nuclear power industry. China's strong nuclear build plan will enable it to develop a very capable and experienced domestic nuclear power industry. When (not if!) China makes a real entry into the nuclear power plant export market, it will be a formidable competitor.

The large CPR1000 build program may also offer a platform for export sales. While considered to be a Generation II design, it incorporates many features of Generation III designs.

Camoens: What does South Korea's entry into the nuclear power export market mean for global nuclear power plant development?

Kee: South Korea's 30-year effort to develop its nuclear power industry has succeeded. Already, the APR1400 is ahead of the Areva EPR in industry league tables. It is essential that the South Korean nuclear industry focus on successfully delivering the UAE projects (i.e., on time, on budget, and with good operational record on startup). If the UAE projects go well, there will be many more market opportunities.

Camoens: How will the nuclear power plant industry in Japan, the US and Europe compete with Chinese and South Korean nuclear power plant vendors?

Kee: In my view, the focus on the US market by some vendors in the last decade was a strategic error. The long US NRC licensing process (i.e., the first construction licenses are not expected until the end of 2011, at the earliest) and the commercial/financial hurdles (i.e., large for the merchant projects, but also present for regulated projects) faced by new US nuclear projects will mean that only a few (four or less) US projects will start construction in the

first wave. Meanwhile, China and other countries are moving ahead now with large build programs.

There is a view that Chinese and South Korean nuclear power plant vendors will have strong cost positions. A bigger competitive advantage is that these vendors have significant support from government owners. These vendors will also have, as a result of current internal/domestic nuclear build, much more experience.

Camoens: **How does the role of government in the Asian nuclear power industry enable nuclear power plant development?**

Kee: There are several ways.

First, the assurance of a market is key; having early orders for multiple units from government-owned utilities is something that western commercial vendors do not have.

Secondly, the national commitment to develop an integrated nuclear supply chain with significant long-term investments in human resources and manufacturing capacity. Like France in the 1970s, a large order of new nuclear units drives supply chain investments and long production lines, which lowers the cost of the nuclear units. Large national nuclear fleets also provide additional benefits in operation and maintenance and fuel cycle.

Third, financial resources are important. For example, the Russian offer to finance, build, own and operate nuclear power plants in Turkey is only possible due to Rosatom's government ownership.

Fourth, the ability to put forward an integrated nuclear power plant offer to outside buyers that incorporates a seamless integrated supply chain. Western vendors must cobble together a series of subcontracts and related agreements from unrelated commercial entities; each of these agreements adds cost (to meet risk premiums and profit margins of subcontractors), risk (as responsibility is shared between multiple commercial entities), and complexity (project management is more difficult due to multiple entities with multiple interests and contractual rights).

Finally, these governments largely avoided the electricity industry experiments in de-regulation, restructuring and electricity markets. In the US and the UK (and in some other countries), electricity generation has been largely privatized with investment decisions made on the basis of commercial outcomes. While this worked well so long as significant baseload generation capacity from the prior era remained in operation, there are serious questions about whether this approach will result in the investment needed to replace

aging baseload generation plants, much less any investments in very-high-capital-cost, very-low-variable-cost nuclear power plants..

Camoens: **In your opinion, is Nuclear a feasible option for the future of power generation or are there still safety, technological and political issues that need to be addressed?**

Kee: In my view, a major shift away from combustion-based energy is inevitable – nuclear power will be a very large part of this shift.

Safety and technical issues related to nuclear power are resolved. With millions of operating hours from hundreds of nuclear power plants, the industry is well down the learning curve. The record of safety and operational excellence in the last decade and longer shows that nuclear power is a safe and mature technology. As we experiment with small and alternate reactor designs, the aim should be to achieve better safety and lower cost.

A key issue is cost. Nuclear power is expensive, in terms of the capital cost of a new plant. While the cost of electricity over a new nuclear plant's 60-year life is low, making the case that customers (or investors) today should pay for a project that will benefit their children and grandchildren is hard. Some governments (e.g., China, Russia, UAE) have made this difficult inter-generational investment decision, but other governments may not find it easy. Commercial utilities may find it hard to do so. It may be difficult for nuclear power to expand significantly in the West without re-thinking the role of government.

Politics and public support remain as issues. There remains some vocal and emotional opposition to nuclear power, with groups like Greenpeace maintaining a constant stream of anti-nuclear messages. I am encouraged that young people seem to be less fussed about nuclear power and that opinion polls show growing support for nuclear power. I am also encouraged that a number of countries without nuclear power are seriously considering it.

As new nuclear power plants are completed and placed into operation, public and political support should grow.