

Corporate policies of the World's reactor vendors

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Do the traditional reactor vendors have a future?

- Areva's rescue might not be possible, its credibility is lost as a result of the QC scandal, the EPR design is irredeemable
- Toshiba/Westinghouse is probably not be rescuable, it is financially tainted, the AP1000 design is irredeemable
- Hitachi has not sold a reactor for 2 decades, it has never exported a reactor, its design, ABWR, is old & has been unreliable
- Does KEPCO have the resources/expertise/credibility/government backing to become a major player? Its design has not been approved by an experienced, open regulator
- Election of a President (May) committed to phase out nuclear takes away political support. Construction suspended on next 2 reactors, oldest reactor permanently closed

Do the traditional reactor vendors have a future?

- Their costs are too high, their traditional markets have disappeared
- Reactor sales now mostly require a comprehensive package of equipment, engineering, training, finance & political support that they cannot provide
- The traditional vendors are too financially weak for the vendor-owned reactor model to work
- If Areva, Toshiba, Hitachi have a future it is in reactor servicing, fuel cycle & decommissioning

Presumed advantages of Russia & China

- Ability to provide a full package including finance
- Expected to be cheaper than other suppliers
- Designs not yet so tainted
- A viable home market to prove new designs
- Government backing export reactor sales as a policy tool

Russia: Rosatom

- Experience of supplying independent designs for 60+ years
- Exported reactors but only to Soviet Republic & Comecon up to 1986. 2 reactors exported to Finland 40+ years ago but only with strong support from Siemens
- Following Chernobyl, no home market orders & only 4 exports (India & China) won from 1986-2007
- All parts of Russian nuclear industry consolidated into Rosatom in 2007 with the backing of Putin

Russia post 2006

- AES-2006 Gen III+ 'safe' design (core-catcher, passive safety, aircraft protection) announced 2006. Four orders promptly placed for home market.
- For Russia, one more AES-2006 ordered (2011) but construction stopped a year later, two reactors using an old design & one fast reactor ordered
- Export orders won in large numbers from 2010 onwards
- By 2017, about 25 orders for AES-2006 – Belarus, India, Turkey, Bangladesh, Vietnam, Finland, Hungary, Egypt, 6 for older designs – China, Iran, Jordan
- About 8 orders for home market expected in next 8 years. Will they happen?
- For exports, only in Belarus & China has construction started

Russia: Issues

- 2 versions of AES-2006, Moscow & St Petersburg. New design VVER-TOI Moscow announced 2010 (20% cheaper & built in 40 months) but still not ordered
- Only 1 of 4 Russian orders completed (02/17) & all 4 are 4 years late. Reactor vessel 'dropped' in Belarus in 2016 causing delays
- Nearly all export orders require Russian finance but sanctions & low oil price mean Russia has little capability to provide finance
- Russia has started building less than 1 reactor per year in past decade. Meeting the export order book & home orders would need Russia to supply about 5 per year. Does it have the supply chain capability to do this?

China

- Three independent state-owned vendors: CNNC established in 1960s & still military/civil company; CGN established 1994 in Guangdong province; SPI established 2007 to import AP1000 technology
- Exports coordinated by CAEA, home orders approved by CNEA but vendors competitors not allies
- CGN supplied CNP1000 (16), ACPR1000 (4) & Hualong One (2)
- CNNC supplied CNP1000 (8), ACP1000 (2, Pakistan) & Hualong One (2)
- SPI supplies AP1000 & CAP14000 but no reactors ordered yet
- In 2013, Chinese gov't asked CGN & CNNC to 'merge' their ACP1000 & ACPR1000 designs to form Hualong One but by 2017, still no decision on which version wins. Did the vendors just change the name of the old design?

China

- From 2007 to end 2010, 25 reactor construction starts, inc. 4 AP1000s & 2 EPRs. Others for old French design (CNP1000) mostly supplied by CGN (some by CNNC)
- All AP1000s & EPRs 4 years late & far over budget
- 2011-16, 11 construction starts, 3 CNP1000 (CNNC), 2 CNNC Hualong One, 4 CGN ACPR1000, 2 CGN Hualong One plus a HTGR (pebble bed)
- CNEA approved 8 reactors to start construction in 2017: 6 AP1000s & 2 CAP1400s. 8 more orders under consideration: 4 AP1000 & 4 Hualong One. By end August, no construction starts in 2017 yet. No more AP1000s till existing plants operating reliably
- Regulatory approval of CAP1400 long delayed. Serious design issues scaling up

China's prospective exports

- China exported 6 reactors, all to Pakistan. No other firm orders, none imminent

Target markets

- CGN: UK (Hualong), Romania (Candu), Kenya
- CNNC: Argentina (Candu), Algeria, Sudan
- SPI: Turkey (AP1000/CAP1400), South Africa

Strengths & Weaknesses of Russia & China

	Russia	China
Finance	Political support but doubtful capability	Probable political support, strong apparent capability but untested
Design capability	Long established	Little tested
Can satisfy experienced independent regulator?	Minimally tested. Finland & Hungary will be a good test	Untested. Review of Hualong One started in UK in 2017
Export order book	Larger than it can handle	None
Supply chain	Weak, quality untested in open markets	Strong, quality untested in open markets
Costs	Little evidence but Finland & Hungary suggest comparable to Areva/Toshiba	No evidence
Home market	Weak, consistently over-estimated	Issues of siting (inland sites banned), over-capacity & technology choice
Construction record	Mostly poor especially with AES-2006, construction mishaps	Good with old design, experience with imported modern designs poor, new designs untested
Industry structure	Consolidated into one massive but unwieldy company	Split between three bitter rival companies

Issues and questions

- What happens if Russian or Chinese government priorities change?

China

- It appears to have the ability to supply & build an old proven design, can it innovate and produce its own design?
- Why has it been unable to win export orders? It has the finance & the supply chain & most of its buyers are not experienced. It has been able to sell the rest of the world everything else
- Are concerns about allowing China to supply nuclear technology misplaced?
- Are concerns about safety culture & quality misplaced?

Russia

- Why is it still seeking export orders when it knows it has neither the finance nor the supply chain to fulfil existing orders?
- Are concerns about safety culture & quality misplaced?