What is killing the Nuclear Renaissance?

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Outline

- The US and UK programmes
- Why are no orders being placed:
  1. The impact of the financial crisis;
  2. Shortages of skills and manufacturing capability;
  3. Unnecessary delays in licensing and planning;
  4. Deficiencies in the designs;
  5. Escalating costs; and
  6. Problems of obtaining finance.
- Conclusions

The US programme

- Announced 2001, first plants to be in service by 2010 but orders not now likely before 2012
- Assumed Gen III+ plants economic but subsidies needed to overcome initial barriers
- Range of subsidies offered but loan guarantees key
- Initially expected to cover 80% of debt, 50% of total cost. Now expected to cover 80% of total cost
- Originally subsidies for 6 units, now 15 (5 designs)
- Expected cost up from $1000/kW to >$5000/kW so loan guarantees up from $4bn to $120bn
- 31 units proposed but many not likely to proceed

The UK programme

- Gen III+ plants not assumed to be economic but government committed not to offer subsidies
- 4 designs examined by NII but 2 withdrawn and issues to be resolved
- EDF and RWE/E.ON both expecting to build 4 units
- EDF will choose EPR but RWE/E.ON have not chosen vendor yet
- Orders not likely before 2013
- Now lobbying by utilities for subsidies, eg a levy or a fixed (high) carbon price

Why no orders?

- **Financial crisis?** Will make finance harder but problems already apparent before
- **Shortages of skills and manufacturing capability?** If Renaissance does start, will inhibit it but not preventing orders now
- **Unnecessary delays in licensing and planning?** Original schedules optimistic but no reason for regulators to delay for no good reason

Design deficiencies: EPR?

- Offered by Areva NP (Areva/Siemens) and derived from Konvoi and N4.
- Certified France, Finland, under review USA, UK
- Chosen by EDF for UK & 6 units proposed for USA
- Under construction Finland, France, on order China
- Olkiluoto > 3 years late and 50-60% over budget after 4 years construction
- Flamanville > 20% over budget after 2 years work
- Instrumentation & control problems: Finnish regulator threatening not to allow start-up and UK regulator not allowing certification

Design deficiencies: AP-1000?

- Offered by Toshiba/Westinghouse and scaled up from AP-600. 4 orders for China
- AP-600 certified by NRC 1997 after 5 years but no sales because not economic
- Certified by US (2006) after 5 more years
- Revisions to design submitted after approval and not expected to signed be off before 2011
- Under review in UK and reports of tension between NII and Westinghouse
- 14 units proposed in USA

Design deficiencies: ESBWR?

- Offered by GE-Hitachi & probably most radical design
- Good progress with NRC but no review outside USA
- 6 units proposed for USA but all in doubt
- Exelon said it wanted ‘more mature designs’ that offered ‘more certain cost structures and better availability of information.’

Design deficiencies: ABWR?

- Offered by GE-Hitachi & Toshiba in competition
- First ordered 1989, certified by NRC 1997
- 4 units in service and 2 under construction in Japan and 2 under construction in Taiwan
- Interest from India but no interest in Europe or China. 4 units proposed for USA
- NRC approval expires 2012: what will be required for renewal (aircraft protection, instrumentation)?
- Will this make it gen III+ (cf AP-1000 experience)?

Design deficiencies: APWR?

- Offered by Mitsubisihi
- Late start with NRC, earlier version reviewed by Japan
- 30 years of development but still no orders
- Only 2 units proposed for USA
- Is Mitsubishi experienced enough? No experience outside Japan

Escalating costs

- Up to 2002, nuclear industry predicted construction costs of $1000/kW
- 2003: Olkiluoto >$2000/kW
- 2007-08: US estimates about $5000/kW
- 2009: Ontario tenders $6700/kW and $10000/kW
- Cost estimates before construction always an under-estimate

Finance

- If cost pass-through to consumers not guaranteed, nuclear is a massive investment risk
- Loan guarantees protect vendors & banks and allow low interest rates (Treasury bond rates)
- They don’t protect utilities from bankruptcy or from falling credit rating
- If costs over-run, borrowing will be very expensive
- Estimated default rate for USA 50% so expensive to taxpayers

Conclusions

- Scale of political support unprecedented
- Pro: decisions on planning, regulatory approval and subsidies
- Con: vulnerable to changes of government
- If fundamentals of technology and economics are not right, political support not enough
- Outcome may be a handful of heavily subsidised units in USA, one or two loss-making plants in UK
- What would be the opportunity cost for renewables and energy efficiency of this?

Déjà Vu?

- In 60s, vendors kick-started ordering with 12 grossly underpriced orders that nearly bankrupted them
- Designs were scaled up too fast and economies made on materials to bail out the economics
- These had consequences on reliability for decades
- Consumers paid for these mistakes
- Is the $1000/kW claim forcing vendors to make similar economies?
- Now mistakes will be paid for by utilities, vendors, banks and taxpayers if loan guarantees are offered