

Reconciling Electricity Markets and New Nuclear Build

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Outline

- What are the economic risks of nuclear?
- Olkiluoto
- USA: Nuclear 2010
- UK: Nuclear power back with a vengeance?
- Can financial instruments deal with risk?
- What is happening to construction costs?
- Subsidies and guarantees: A financier's wish list

Nuclear power in competitive markets

- Long believed that new nuclear orders not possible in a competitive electricity market
- High economic risk of building power plants would give high cost of capital disadvantaging any capital intensive technology
- Construction cost & time guarantees, & performance guarantees impossible
- Many costs not under control of plant owner
- Additional risks arise from political factors and safety issues

Nuclear power in competitive markets

But

- 2002: USA, Bush launched programme that would provide subsidies for 4-6 plants to kick-start unsubsidised ordering
- 2004: Finland, part of most competitive market in Europe, ordered a nuclear power plant
- 2006: France, bound by EU Electricity Directive, ordered a new nuclear plant
- 2006: UK, pioneer of competitive electricity markets, announced that 'nuclear power is back with a vengeance' despite a commitment not to subsidise
- Can nuclear power survive without public subsidies and guarantees?

What are the risks?

- Construction cost & time: Record of nuclear industry building to time and cost is appalling. Large number of contractors, large amount of on-site work mean a vendor would be mad (or desperate) to offer turnkey terms. Late completion means high replacement power costs would be incurred
- Operating performance: Reliability of nuclear plants has been far worse than forecast although now generally good. But 4 most recent French plants were very unreliable. No vendor will guarantee the reliability of a nuclear plant

What are the risks

- Operating costs: Expected to be low but are much higher than forecast. Some nuclear plants retired in USA due to high costs and British Energy bankrupted in 2002 because operating costs were higher than wholesale electricity price
- Decommissioning & waste: Difficult to estimate because no experience of high or intermediate-level waste disposal or full decommissioning. Estimated costs rising rapidly. But so far in the future, discounting makes the costs disappear and, realistically, do shareholders, financiers & companies care?
- Insurance & liability: Likely to continue to be covered by international conventions

Olkiluoto

- Finland has outstanding nuclear reliability record with 4 medium-size units, 2 Russian PWRs, 2 Swedish BWRs
- Areva NP (70% Areva, 30% Siemens) desperate for orders for their new design, EPR, which completed regulatory approval in France in 2000
- Finnish government trying to get new nuclear order placed since 1992
- Finland part of the Nordic electricity market covering Finland, Norway, Sweden and Denmark. Widely seen as most competitive electricity market in the world
- So an order for Finland was a massive boost for the nuclear industry

Olkiluoto: What are the terms?

- Construction cost: €3bn (\$4.7bn or \$3000/kW) turnkey contract including first core and IDC
- Penalty clause for late completion up to 10% of cost (0.2% of contract cost per week)
- 2/3 of cost (€1.95bn) provided by loan from syndicate of banks led by publicly owned Bavarian Landbank at 2.6% interest
- €650m export credit guarantee provided by French government & €110m by Swedish government
- Customer (TVO) is majority owned by a not-for-profit utility (PVO) that is owned by Finnish industry and provides power to them
- Output is contracted to PVO for life of plant on cost + terms

Olkiluoto: What is the experience?

- Poor quality concrete & welds, delays in design completion, problems with subcontractors, inadequate protection against aircraft crashes
- Costs now €1-1.5bn (\$1.5-2.2bn) over budget
- Plant is now 2 years late & penalty clauses reached the maximum at 12 months
- Turnkey contract under strain:

Areva 'Areva-Siemens cannot accept 100 per cent compensation responsibility, because the project is one of vast co-operation.'

TVO 'I don't believe that Areva says this, the realisation of the project is Areva's responsibility'

- Now speculation Areva will sue TVO because they have taken too long to carry out checks

What does Olkiluoto prove?

- Turnkey contracts are a huge risk to vendors
- Construction cost and time risk is not overcome by the EPR
- Lack of experience of reactor construction and decay of nuclear skills is big problem - more concrete problems at Flamanville
- Even with a turnkey contract, the customer still bears huge risks from replacement power costs
- The order was only possible with sub-economic loans and loan guarantees

USA: Nuclear 2010

- Original objective: to obtain NRC approval of three sites for construction of new nuclear power plants under the Early Site Permit (ESP) process, and to develop application preparation guidance for the combined Construction and Operating License (COL) and to resolve generic COL regulatory issues
- 'Nustart' (consortium of 8 US utilities) and Dominion initially selected as companies to receive the subsidies but now a long queue of utilities

USA: Nuclear 2010

- Most important nuclear provisions of Energy Policy Act (EPACT) 2005 offered three types of support
- Limited number of new nuclear power plants can receive a \$18/MWh production tax credit for up to \$125m per 1000MW (or about 80 per cent of what the plant could earn if it ran 100 per cent)
- Provision for federal loan guarantees covering up to 80 per cent of the debt involved in the project (not the total cost)
- Up to \$500m in risk insurance for the units 1-2 and \$250m for units 3-6. This insurance is to be paid if delays not due to the licensee slow licensing
- Support for R&D funding worth \$850m and help with historic decommissioning costs worth \$1.3bn.

USA: Nuclear 2010

- But clear from early on that this was not enough
- [TXU CEO John Wilder] said there were now projects totalling about 26GW lining up for limited federal incentives, which could provide 'anywhere from a \$2/MWh advantage to a \$20/MWh advantage.' He said he didn't believe it would be known which companies would receive those benefits until about 2012. 'Quite frankly, that's all the difference between these projects working or not working,' he said.
- Exelon Nuclear's President Christopher Crane said that the incentives were a key factor in his company's decision to prepare a COL. But other factors would influence whether Exelon commits to building a new reactor.
- Sticking point is loan guarantees:
- Nuclear industry lobbying for 100% debt coverage for up to 80% of the project cost
- A clause in an Energy Bill passed by Senate allowed provision for up to \$18.5bn in loan guarantees for new nuclear power plants in 2008/09

What does Nuclear 2010 prove?

- New plants in USA seem implausible without government loan guarantees
- Guaranteed power purchase prices and markets for the power may be important
- Plants will be easier to build in states whgo back to cost of service regulation
- Subsidised orders may be possible if enough subsidies are offered, but unsubsidised orders seem unlikely

The UK programme: Moving ground

- 2003: 'Our priority is to strengthen the contribution that energy efficiency and renewable energy sources make to meeting our carbon commitment. The current economics of nuclear power make it an unattractive option for new generating capacity'
- 2006: 'One fifth of our electricity is from nuclear, if the market came forward with something to replicate that, that would make a useful contribution to the mix. We are not going to do anything to facilitate that'
- 2008: 'A more significant expansion - way beyond simply replacing existing reactors as they are decommissioned - is vital to ensure Britain's lights stay on. We have a decisive role to play in facilitating that necessary investment.'

The UK programme: Subsidies?

- 2006: 'No cheques will be written, there will be no sweetheart deals. There will not be any special fiscal arrangements for nuclear. We are going to make sure that the full costs of new nuclear waste are paid by the market.'
- 2008: 'The Government [will] set a fixed unit price [for] waste disposal at the time when the approvals for the station are given, prior to construction of the station. Should the actual costs of providing the waste disposal service prove lower than expected, these lower costs will not be passed on to nuclear operators.'
- 2008: 'Nuclear must be right at the heart of the energy mix in the UK in the future. We will do whatever it takes to clear the path.'
- If the government's no subsidies promise is clearly broken, will orders be politically acceptable in the UK and under EU competition legislation

Can financial instruments deal with risk

- Newbery says risk of building new nuclear in a competitive electricity market can be dealt with by financial instruments
- 'The kWh bond will pay the holder the average British pre-tax price of electricity for each kWh specified on the bond. For example, if the average UK retail electricity price (the average unit cost for a 3,300 kWh/year direct debit customer) is £0.09/kWh and the bond is for 100kWh, the annual dividend will be £9'
- 'If retail electricity prices rise because wholesale prices rises, the bond pays out more and compensates the consumer for a rise in bills. If the electricity price falls, the bond pays less but consumers' electricity bills are reduced, leaving them no worse off.'
- Would consumers really be interested in spending money now to fix the electricity price they pay in 6 years?

Can financial instruments deal with risk

- Newbery says the main risk is the market - the risk that the wholesale price will fall below nuclear cost
- 'Equipment suppliers claim that their new plants are reliable and that standardised designs can be delivered on time and to budget. If governments offered guarantees against changes in safety rules, regulatory risk could also be reduced. Suppose that construction, operating and regulatory risk can be insured, leaving only market price risk'
- What is the evidence that construction and regulatory risk can be insured?
- 'What is needed is financial creativity to make it look less risky to retail investors.' Insurers are not so foolish as to believe that risk can be made to disappear. It exists and if they are being asked to insure against it, the premium they require will reflect the level of risk.

Construction cost estimates

- Late 1990s, \$1000/kW was claimed for new Gen III(+) designs
- 2004: Olkiluoto contract price \$3000/kW but outturn not less than \$4000-4500/kW
- But since then, estimated costs have escalated even more
 - Keystone - \$3600-4000/kW (June 2007)
 - S&P - \$4000/kW (May 2007)
 - Moody's - \$5000-6000/kW (October 2007)
 - FP&L - \$5700-8020/kW (Fall 2007)
 - Puget Sound Energy - \$10,000/kW (January 2008)
 - E.ON (UK) - \$6,000/kW (May 2008)

The China Effect (AEP)

Commodity	Esc 86-03	Esc 03-07	Ratio vs. History
Nickel	3.8%/yr	60.3%/yr	15.9x
Copper	3.3%/yr	69.2%/yr	21x
Cement	2.7%/yr	11.6%/yr	4.3x
Iron/Steel	1.2%/yr	19.6%/yr	16.3x
Heavy construction	2.2%/yr	10.5%/yr	4.8x

What is happening to construction costs?

All generation technologies hit by China effect but nuclear much more so than others. What other factors?

- More realistic estimates as companies have to deliver on their promises
- Learning from Olkiluoto
- Depreciation of the dollar
- Will manufacturing bottlenecks and skill shortages make things even worse?

Which if any of these factors is reversible?

Subsidies & guarantees: A financier's wish list

- Government-backed loan guarantees
- Turnkey construction contract
- 15 year power purchase agreement indexed to costs
- Performance/reliability guarantee
- A guarantee on operating costs
- A cap on decommissioning liabilities & waste
- Insurance guarantees against regulatory and judicial delays and the consequences of events elsewhere in the world

Conclusions

- Evidence from Finland, USA & France does not show that new nuclear can be built without special arrangements to protect them from the market
- Until there is a solid record of achievement and vendors will back sales with full cost & performance guarantees, as in combined cycle plants, financiers will see nuclear investment as risky
- Other serious problems are the alarming rise in construction cost estimates, emerging skills shortages and production bottlenecks that will not be quick or cheap to overcome
- The people the nuclear industry must convince are S&P, not the public

	UK Dash for Gas	Olkiluoto	USA	UK
Loan guarantees	No	Yes	Yes	?
Turnkey price	Yes	Yes	No	No
Fixed lead-time	Yes	Yes	No	No
Regulatory delay insurance	n/a	No	Yes	?
Performance	Guaranteed	No	No	No
Sales volume	Contracted	Contracted	?	?
Price	Guaranteed	Cost-plus	Subsidy	?
Operating costs	Guaranteed	No	No	No
Decommissioning	n/a	No	No	Part fixed
Waste disposal	n/a	No	No	Fixed