A nuclear renaissance for Europe?

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Overview

- Will nuclear renaissance be self-defeating – 'peak uranium', relatively high carbon emissions?
- How effective is nuclear power for energy security, variously defined?
- The evidence on 'engineering' economics of nuclear power
  - Appraisal optimism
  - Economies of scale in single units
  - Economies of replication or learning in programmes

How far might Generation IV and/or smaller reactors help?

A self-defeating renaissance?

Two arguments sometimes used – both threadbare

1. Uranium will become scarce and very expensive: NEA/IAEA data suggesting we *already* know there are resources to last 50-100 years – more to be found as/when price rises and uranium ore is only c. 2% of generating cost
2. Nuclear is not genuinely low carbon: in practice it's comparable to a range of renewables in carbon terms – long periods of concentrated power offset front/back end carbon

There are other issues- waste, safety and proliferation - but these don't cast doubt on low-C *technical* feasibility

Is nuclear good for energy security?

Distinguish different dimensions of security

- Fossil fuel scarcity/external disruption
- Lack of domestic investment
- Technology/infrastructure failure
- Domestic activism/terrorism

Nuclear scores differently on these dimensions: good for less dependence on imported/expensive fossil fuel: very slow acting if there are ‘electricity gaps’; possibly problematic over terrorism; cannot help directly help gas security

Security case is therefore ambiguous: much depends on weighting of security risks

The major obstacle: cost

- Contexts: two-thirds of nuclear generating cost is construction; only Finland/France in EU-15 starting new projects; history of ‘appraisal optimism’ especially acute
- Finland project now running at ‘around double’ the ‘turnkey’ original estimate of 3.2 bn euros; 5 years late
- French project is also getting close to doubling in cost – from 3.3 bn. to c. 6 bn. euros. This is more surprising than the Finland result: second-of-a-kind not first, and being built in home/favourable technical/political climate

Economies of scale and number/learning?

- Classic ‘engineering’ economies of scale expected as unit size rose from 900 MW to 1300/1400/1650 MW: evidence very scant on this although limited econometric evidence suggests that in practice these economies are at best limited and in some cases may not exist
- Also expected are economies of replication and learning: but Grubler study of French 58 GW PWR programme – where the effect should be most marked - shows costs more than doubling by end of programme

How far are new/smaller designs likely to offer lower costs?

- Significant publicity in recent years for the so-called Generation IV reactors, led from USA.
- Many possibilities and now six main options under development: four are high temperature reactors, four are fast reactors and five of the six would use radically different coolants (helium, sodium etc). Impossible to forecast their costs yet: most unavailable until 2030 or well beyond
- Some small reactors are potentially available more quickly: PBMR was the front-runner but now abandoned – many other designs are under development. But again no credible cost figures and acceptance issues mean no early deployment

Conclusion

- Even before Fukusima Daiichi, the nuclear renaissance in Europe was not in practice progressing fast
- ‘Engineering’ based cost issues remain problematic – ‘appraisal optimism’ remains serious, and evidence both on economies of scale for individual units and economies of replication and learning on programmes is not promising historically
- Generation IV and/or smaller reactors unlikely to be available, acceptable or reliably cheap for decades
- Contribution of nuclear to low carbon future will be modest