Risktec

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Nuclear Power

If there's a will, there's a way

The publication of the UK government's energy review in July 2006 [Ref. 1] signalled the re-emergence of nuclear power as a politically viable means of providing a balanced proportion of the country's future energy needs. The energy review concludes that "higher projected fossil fuel prices and the introduction of a carbon price to place a value on CO_2 have improved the economics of nuclear as a source of low carbon generation" and that "new nuclear power stations would make a significant contribution to meeting our energy policy goals".

With the necessary political will seemingly in place, the challenges for the nuclear industry can be brought into sharper focus. These are interlinked and include:

- Financing of new build projects
- Choice of reactor design
- Waste disposal
- Streamlining regulatory and planning consent

Financing of new build projects

In its energy review, the UK government makes it clear that it expects the private sector to "initiate, fund, construct and operate new nuclear plants and to cover the full cost of decommissioning and their full share of long-term waste management costs". This demanding expectation is tempered with promises to address potential investment barriers to new nuclear build, including:

- Introducing the concept of pre-licensing by the Nuclear Installations Inspectorate
- Decoupling regulatory assessment from the land-use planning application
- Providing a decision on the long-term management of radioactive waste

Even with these measures in place, there is speculation that the government will need to provide incentives to attract investors. The short-term and volatile nature of the electricity market in the UK makes long-term investment presently unappealing.

This situation is compounded by the state of the carbon market, which was introduced by the EU Emissions Trading Scheme in January 2005. Although carbon trading should, in principle, allow energy businesses to profit from low CO_2 emissions, in practice the price of carbon has fluctuated too wildly to back investment decisions. Until the carbon market stabilises, capital outlay in new nuclear power stations may not be tenable unless businesses can secure some form of guaranteed premium (as is currently the case for renewable generation) or a long-term price assurance from the government.

Reactor design

The front runners for new build appear to be the Framatome ANP European Pressurised water Reactor (EPR) and the Westinghouse AP1000 (see Figures 1 & 2 and Table 1). These Generation III+ Pressurised Water Reactors (PWRs) claim to offer improved safety, reduced construction and operating costs, reduced build times and increased operating lifetimes.

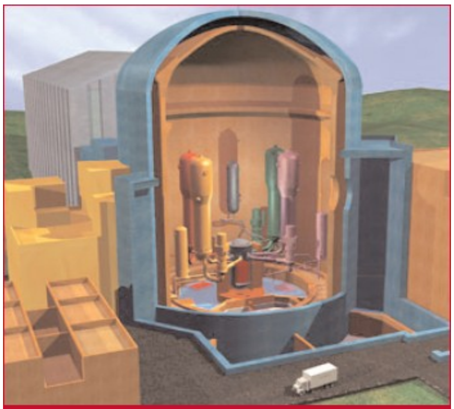


Figure 1 – Framatome EPR

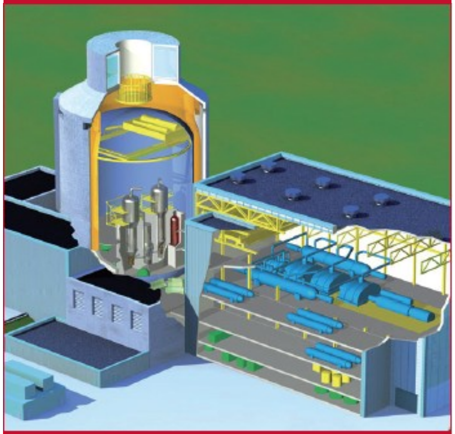


Figure 2 – Westinghouse AP1000

Did you know...

...that nuclear power is surprisingly widespread?

- Nuclear energy supplies over 16% of the world's electricity.
- There are 440 civil nuclear power reactors in 31 different countries, including the US, Canada, Western Europe, Japan and Korea.
- Today there is as much electricity generated by nuclear power as from all sources worldwide in 1961.
- 56 countries operate more than 280 research reactors.
- Over 200 reactors are currently used for naval propulsion.
- France generates over 75% of its electricity from nuclear power and is the world's largest electricity exporter.
- The UK currently has 23 reactors, which generate over 20% of the nation's electricity.

Sources:

1. www.uic.com.au 2. www.world-nuclear.org

Table 1 – Future Candidates for Nuclear New Build

	Description	Output (MWe)	Life (Years)	Build Cost ($/KWe)
AP1000	A pressurised water reactor with passive safety systems, including passive safety injection, passive residual heat removal and passive containment cooling.	1,100	60	1,200 – 1,500
EPR	A pressurised water reactor with four redundant trains of cooling safeguards housed in four separate buildings. Capable of withstanding impacts from a commercial aircraft.	1,600	60	1,800
PBMR	Helium cooled, enriched uranium fuelled reactor. Fuel is in the form of spheres of graphite coated enriched uranium about the size of a tennis ball. These pass through the reactor and out the other side for disposal or recycling through the reactor.	165	40	1,000
ACR-1000	A pressure tube reactor using heavy water as its moderator at relatively low pressures and light water as coolant. Uranium fuel is only slightly enriched and fuelling can be achieved on line.	1,200	60	1,000

An EPR is under construction in Finland having been granted permission to proceed by Finnish regulators, while the AP1000 has been given 'Design Certification' by US regulators for certain applications, but has not yet been built. These types of reactors are similar in principle to the UK's Sizewell 'B' PWR.

Outsiders include the Canadian Advanced CANDU Reactor (ACR), which is a pressure tube reactor, and the Pebble Bed Modular Reactor (PBMR), which is due to start construction in South Africa in 2007 [see Table 1].

Waste disposal

The UK's position on nuclear waste is outlined in the energy review [Ref 1]. For intermediate and high level waste the Committee on Radioactive Waste Management (CoRWM) has proposed that deep geological disposal in a repository is the best option, with a programme of interim storage until this facility can be made available. For Low Level Waste the use of purpose built surface level facilities appears to be the current preference.

For the moment, there appears to be no strategic plan to replace the reprocessing facilities at Sellafield, presumably because of the high dependency on the choice of new reactor design. The government has, however, accepted overall responsibility for managing waste, but expects the costs to be borne by the nuclear power generation industry.

Regulatory & planning consent

To build a new nuclear power station in the UK consent is required from the government, to ensure that it fits in with overall energy policy. A licence is needed from the Nuclear Installations Inspectorate, which deals with safety, and the operator needs to be authorised by the environmental regulator to release small quantities of radioactivity in routine discharges. Additionally, planning permission for a particular site is required to assure compatibility with local intentions for the use of land, which can lead to a public enquiry covering all aspects of consent.

As part of the energy review, the government is airing proposals to streamline the planning consent process. Strategic and regulatory issues would be dealt with outside the public enquiry process, which would be constrained to examining local planning issues.

To support this initiative, the UK's Health & Safety Executive (HSE) undertook a public consultation between March and April 2006, to shape proposals for reforming the regulatory process [Ref 2]. The outcome is a scheme with two phases of licensing. Phase 1 is design specific, but would include the assessment of generic site hazards, such as earthquake or aircraft impact. It may also take into account approvals from nuclear regulators elsewhere in the world, and would invite review and comment from the general public. Phase 2 would address any site specific issues not covered by Phase 1, and would ultimately result in the granting of a site licence [see Table 2].

Conclusion

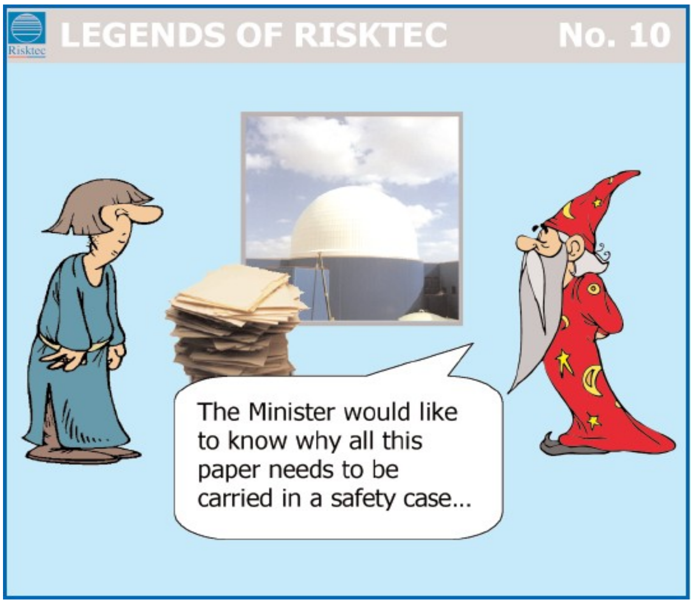
As the political obstacles facing nuclear power subside, the remaining challenges are no less daunting and are inextricably entwined. The planning and regulatory consent process may influence the choice of reactor design and siting, which influence and are influenced by commercial considerations and the waste management strategy. Although it is still unclear how government and the private sector will work together, the boundaries of this multi-billion pound enterprise are beginning to be drawn.

References

1. DTI, The Energy Challenge, Energy Review Report 2006
2. HSE, The Health & Safety Risks and Regulatory Strategy Related to Energy Developments, June 2006

Table 2 - Proposed Licensing Process

Step	Process	Timescale
Phase 1: Design Acceptance		
1	Produce design & safety case submission based on generic site envelope – site and operator neutral, but covering design, and aspects of construction, operation, maintenance & decommissioning relating to the design.	Applicant-based
2	Fundamental safety review – a short review to identify any major design or safety weaknesses that would prevent granting of a licence.	3-6 months
3	Overall design safety review – a more in-depth review of the design against the Safety Assessment Principles, including aspects such as passive safety, separation, segregation and redundancy.	6-12 months
4	Detailed assessment for design acceptance – a more comprehensive examination of all aspects of the submission, including ALARP assessments and independent verification by HSE. The outcome would be a Design Acceptance certificate with appropriate caveats.	2 years
Phase 2: Site Licensing		
1	Site licence assessment – a verification that the assessment of the Accepted Design remains valid at the specific site, as well as assessment of specific site issues and the operating organisation.	6-12 months



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