Factfiles

The Institution of Engineering and Technology

Nuclear Power in a Diversified Energy Portfolio

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First Edition March 2006
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Cover images (clockwise from top left)

- Nuclear power station at night
- Sizewell B nuclear power station, UK
- Nuclear power station ar night
- CANDU nuclear power station, Canada

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Summary

The Institution of Engineering and Technology (IET) and the UK's major Engineering Institutions believe that the security of energy supply should be safeguarded by fostering a diversified portfolio of low-carbon energy options. This briefing provides an impartial background on the engineering and technology aspects of nuclear power to enable informed political decisions on energy policy. By providing this briefing, the IET is not advocating nuclear power, but is simply laying out the relevant facts.

Nuclear power in a diversified energy portfolio

No energy option is risk-free or capable of providing a single solution to our energy needs, but the risks and costs associated with nuclear power are now relatively well-understood. As nuclear power becomes a more politically credible option, policy-makers will need to be aware of a number of practical engineering and technology considerations, gained from practical experience of over 50 years of nuclear power operations worldwide.

Nuclear fission is a proven and reliable power generation technology. There are no technical or safety arguments for excluding it from the energy mix.

- Over 440 nuclear plants are in operation globally, with total experience of 12,000 operating years.
- The majority of operating experience (8,000 operating years) has been achieved since the Chernobyl incident in 1986.
- The Chernobyl reactor design would never have been licensed in the West. Since Three Mile Island in 1979, there has been no major safety incident involving a 'western' reactor design.
- Four new nuclear stations were connected in 2005, and a further 24 stations are under construction.

The disposal of nuclear waste is a 'live' issue regardless of an outcome for or against new build.

- New nuclear build to maintain existing capacity would add only in the order of 10% to existing waste - although the proportion of high-level waste will increase to a greater degree.
- There is broad international consensus on the technology for storing nuclear waste, and the Committee on Radioactive Waste Management (CoRWM) will identify options for the long term storage and disposal of radioactive waste in the UK in its report this summer.

Construction and operating costs for nuclear power stations are becoming increasingly well-defined and may be expected to become competitive relative to other forms of generation.

New plant constructed overseas within the last 10-15 years has been completed within schedule and cost. However, such gains could be mitigated by late entry into an increasingly competitive global market for nuclear technology and fuel.

The long time scale for investments in nuclear power makes them very sensitive to policy reversals, and uncertainty acts as a major deterrent to private investment.

- The lifetime of new plants can be expected to span as many as three generations. It may be over 80 years from start of planning to end of basic decommissioning, assuming an operating life of at least 50 years.
- The time from decision to completion alone will extend over at least two parliaments. Recent overseas projects have been completed within the typical 5-year construction schedule; the current UK planning and licensing arrangements would add another 5-8 years prior to the start of construction.

More detailed technologically-related considerations could have a significant impact on the delivery of new nuclear build. There is a need for strategic thinking to consider their potential implications.

- There are a number of hidden resourcing risks which are specific to nuclear power. These include most notably the need for a skills base for licensing, construction and operation of new plant, and the global manufacturing capacity for components for nuclear reactors. Growing international demand may mean that both of these can be acquired only at a premium.
- The licensing of specific nuclear technologies will also have to be considered in a global context. Taking advantage of international collaboration on safety standards could significantly reduce risk and timescales for new build.
- While it is pragmatic to consider locating new build on existing sites, not all current nuclear sites will have adequate infrastructure for new generation nuclear plant. Those scheduled for closure first are the Magnox stations which are modest in size and typically have only 132kV grid connections. New build would require 400kV connections and could therefore create contention over gaining planning consent for upgrades to the lines for these sites.

Above we have outlined the key engineering and technology aspects of potential new nuclear build. We have not examined the policy considerations, which we acknowledge to be far from trivial but beyond our core area of expertise. These will need to include:

- Putting in place a robust long-term regulatory and financial framework which will not destabilise investor confidence in other low-carbon technologies;
- Understanding and addressing public concerns.

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Further Information

- **IET Energy related factfiles**
  http://www.theiet.org/factfiles/energy/index.cfm

IET nuclear factfile series

- **The principles of nuclear power**
  http://www.theiet.org/factfiles/energy/nuc-prin-page.cfm
- **Nuclear reactor types**
  http://www.theiet.org/factfiles/energy/nuc-reac-page.cfm
- **Nuclear safety**
  http://www.theiet.org/factfiles/energy/nuc-safety-page.cfm
- **Legal framework of nuclear power in the UK**
  http://www.theiet.org/factfiles/energy/legal-frame-nuc-page.cfm
- **Nuclear decommissioning**
  http://www.theiet.org/factfiles/energy/nuc-dec-page.cfm
- **Nuclear waste disposal and transport of spent fuel**
  http://www.theiet.org/factfiles/energy/nuc-waste-page.cfm
- **The nuclear fuel cycle**
  http://www.theiet.org/factfiles/energy/nuc-fuel-page.cfm
- **The radioactive decay of uranium^{238}**
  http://www.theiet.org/factfiles/energy/uranium238-page.cfm
- **Glossary of nuclear terms**
  http://www.theiet.org/factfiles/energy/nuc-terms-page.cfm

Further Reading

- Wood, J. **Nuclear Power** (IET Power and Energy Series 52); Institution of Engineering and Technology (2007) ISBN 0863416683

This briefing was prepared by the IET and supported by:

- The Energy Institute
- The Institution of Chemical Engineers
- The Institution of Civil Engineers
- The Institution of Mechanical Engineers

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