



Facts and Trends

NUCLEAR

CONTEXT

- Nuclear energy was rapidly developed for civil use during the 1960s, with a slowdown following the accidents of Chernobyl and Three Mile Island. Nuclear had a 17% share in world power generation in 2002. It provides the majority of electricity in France and is also widely used in other countries such as the USA, the UK, Sweden, Finland, China and Japan.
- While some major developing countries (China, India) have confirmed their willingness to build nuclear plants on a wide scale, the issues of rising energy demand, supply security and climate change have led to a new debate over the future role of nuclear in several developed countries (the USA with the 2005 Energy Bill, the UK, Italy, Poland).
- Relatively expensive to build but cheap to operate, nuclear can be competitive with coal or gas-fired generation in some countries, even without including any considerations of paying the costs of CO₂ release.
- There is sufficient uranium – most of it located in “non-sensitive regions” – to build and operate more than four times the number of nuclear plants currently in use. The uranium resource lifetime could be extended by approximately 15% through reprocessing spent fuel to make mixed oxides (MOX) and by up to a factor of 50 by using “fast breeder” reactors (there would then be enough resources to operate 225 times the current nuclear fleet). Virtually all the wastes it produces are contained and managed, and nuclear power does not cause any CO₂ emissions during operation.

- Today, the vast majority of nuclear power is based on “Generation II” light water reactors. New plants to 2040 are likely to be “Generation III” light water reactors, incorporating many improvements, particularly safety and economic performance. From 2040-2050 “Generation IV” fast breeders could come online.

ISSUES

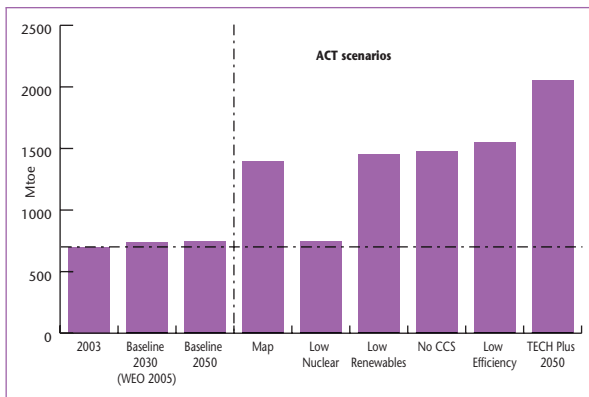
- 90% of waste produced by nuclear power has low radioactivity and is disposed of in shallow storage sites. Public concern has concentrated on the 10% high level waste (HLW). Part of this is highly radioactive and will remain so for a few hundred years. The remainder has a low radioactivity level but will remain so for some tens of thousands of years. This HLW can be vitrified, which allows safe storage over a very long period. Fuel reprocessing can substantially reduce waste volume. Final disposal of HLW is regulated by governments, not by the industry. Most national authorities plan to dispose of HLW from nuclear power generation in deep, stable geological formations.
- Nuclear also faces challenges in public acceptance because of lack of transparency in the past.
- Safety has always been a very high priority in nuclear reactor design, engineering and operation. About one-third of the capital cost of a typical reactor arises from safety systems and structures; and the safety record of nuclear energy is better than for any other major industrial technology in OECD countries.



THE WAY FORWARD

- The possibility that nuclear power could be a major component of the hydrocarbon-free generation required to address climate challenges has been fully recognized by the International Energy Agency (IEA) in its 2006 “Accelerated Technology (ACT) scenarios”. These build on the opportunities delivered by existing and emerging technologies to define an energy future meeting those challenges.

World nuclear energy use by scenario, 2003-2050



Source: International Energy Agency (IEA). *Energy Technology Perspectives*. 2006.

- Experience tells us that nuclear power can be a safe and economic means of generation, ensuring security of supply and enjoying public acceptance, if it is supported by a competent and credible safety authority, clear and coherent license design and siting procedures, and if industrial organization allows for standardization and the associated economies of scale.
- Ensuring public acceptance through stakeholder participation in structuring choices is key, in particular with regard to legitimate concerns about waste management and the safety and security of installations.
- Governments of countries that master nuclear technologies and envisage using nuclear power in the decades to come must take the steps required to do so effectively. In countries with successful past experience, maintaining the existing nuclear regulatory framework and allowing utilities to use viable industrial models (diversified business portfolio, long-term contracts with customers, risk-sharing industrial consortia) should be sufficient. In countries with less successful experience, governments should ensure that all success conditions previously mentioned are met and might also consider giving investors initial financial incentives and/or accept some risk transfers.
- R&D programs that prepare for the future, i.e., that pertain to Generation IV reactors, must be pursued as public-private partnerships and real collaborative research. They must be managed at the global level to cover all options with reasonable redundancies and develop world reactor standards at least cost.
- Various initiatives have been taken recently to develop regional or international partnerships on fuel cycle management. They should be supported since such partnerships would allow all countries wishing to use nuclear power peacefully to take the advantage of an optimized and secure fuel cycle, including fuel reprocessing.

