Case study: nuclear power

L.E.J. Roberts

Lewis Roberts is a physical chemist who worked in the Atomic Energy Research Establishment at Harwell, where he was Director from 1975 to 1986. He then became the Wolfson Professor of Environmental Risk Assessment at the University of East Anglia, Norwich, until 1991. He is the author of Nuclear Power and Public Responsibility (Cambridge University Press, 1984) and a co-author of Power Generation and the Environment (Oxford University Press, 1990).

6.1 INTRODUCTION

The generation of electricity from nuclear power currently contributes 17% of the world's electricity. The installed capacity grew from the first commercial plants in the early 1960s to reach 110 GW by 1979 and 318 GW by 1990, distributed between 26 countries. There are 96 further reactors being constructed which, if they are completed, would bring the total nuclear generating capacity to 400 GW by the year 2000. France has the highest percentage of nuclear generation (75%) and ten countries rely on nuclear stations for one-third or more of their electricity (IAEA, 1990). The overall contribution to the world's energy supply is about 6%, almost the same as the current contribution from hydropower.

Nuclear construction programmes have been cut back in recent years because of doubts about costs and safety. The two are linked, as the

Environmental Dilemmas  Ethics and decisions
Edited by R.J. Berry
Published in 1992 by Chapman & Hall, London. ISBN 0 412 39800 1
additional costs of safety measures and the long and expensive procedures necessary to prove a safety case are an important factor in increasing costs. Nuclear power is capital intensive, with relatively low fuel costs. Therefore the competitive position of nuclear power depends mainly on the real discount rate assumed and on projections of future fossil fuel costs. A recent study of the lifetime costs of nuclear- and coal-fired stations, counting all costs from construction to final dismantling, showed that nuclear generation was cost competitive except in those countries that used discount rates above 8% and low prices for imported coal (Jones and Woite, 1990).

As well as a hope of lower costs, the original incentive to build nuclear stations was the prospect of a large-scale source of energy which was independent of the supply of fossil fuels. Diversity of supply is still an important strategic gain, as was emphasized by the Inspector at the recent Hinkley Point Inquiry (Barnes, 1990). He listed three advantages of a policy of diversity: (1) some security against interruptions in the supply of fossil fuels, (2) some security against volatile movements in the price of fossil fuels, and (3) security against long-term uncertainties, such as possible restrictions on burning fossil fuels because of the environmental damage that results.

It seems likely that the last point, the environmental advantages of nuclear power, will become an increasingly important factor in the arguments about its future use. These environmental advantages derive from the small quantities of fuel required and the virtual absence of atmospheric pollution. In order to generate one giga watt of electricity for a year (1 GW(e)yr), it is necessary to mine and transport only 200 tonnes of refined uranium, derived from about 100 000 tonnes of crude ore, compared with some 3.8 million tonnes of coal, or 2.2 million tonnes of oil. Land use, transport and waste disposal requirements are correspondingly low. But the absence of atmospheric pollution may be a more critical benefit.

Nuclear power stations operate on closed cycles, so that atmospheric emissions are very low. They emit no acid gases and little carbon dioxide. The environmental damage caused by the acidic gases produced by burning coal or oil and the health effects in areas of high pollution are well recognized. The possible effects on the world's climate of increasing carbon dioxide and methane concentrations in the atmosphere are currently the subject of much research. The concentration of carbon dioxide in the atmosphere is 25% higher than in pre-industrial times, mainly because of fossil fuel combustion. International negotiations are taking place aimed at stabilizing or even reducing carbon dioxide emissions (Roberts et al., 1990). This will be a difficult task, given the predicted expansion of the world's population from 5 billion to 8 billion by the year 2025, an expansion that will occur mainly in developing countries.