Economics of Nuclear Power

fact sheet
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Industry based costings are unreliable and unverified. The nuclear industry has been hugely subsidised.

Nuclear power is currently more expensive than wind power in the UK and USA.

The key determinants of the cost and economic viability of nuclear energy include:[1]

- the capital costs of reactor construction
- the time taken to build the reactor
- the interest rates associated with project financing
- the reactor's efficiency and performance
- the costs of adequate liability insurance relating to accidents and terrorist acts
- the required rate of return on capital investment
- the costs of reactor decommissioning
- the costs of radioactive waste storage and disposal

Comparisons between the costs of nuclear energy and energy from other sources are usually distorted in favour of nuclear power by overstating likely reactor performance, understating the time taken to build the reactor and therefore of the costs of financing construction, understating the required rate of return, understating the costs of accidents (the liability of plant owners is limited by governments and therefore the real cost of an accident will be borne by the state), and excluding estimated costs of reactor decommissioning, waste storage and disposal. The costs of waste storage and disposal have usually been subsidised or borne entirely by the state, and the costs of decommissioning are hard to forecast. A fully competitive electricity market may favour other energy technologies and further increase investment risks and therefore costs to nuclear producers and energy users.

A report to the UK Sustainable Development Commission points out difficulties of obtaining objective data on the economics of nuclear power. The following concerns apply equally well to Australia:

> "There are few sources of data on the costs of future nuclear power that relate directly to UK circumstances… The problematic category is capital costs, where there is no recent European or North American experience. Examination of the limited number of published capital cost estimates that apply directly to the UK shows that all appear to derive from studies originally designed to apply to other countries *and from vendors of reactor systems*." [2] (our italics)

Other problems arise where studies fail to identify the discount rate used to convert capital cost in dollars per kilowatt into a levelised cost of electricity in cents per kilowatt-hour; some studies address new or modified types of reactors that are only in the design stage and have not been built; some studies do not specify the year of the currency; and most studies do not reveal whether they assume that a single reactor or a batch of identical reactors is ordered, yet the expected cost depends strongly upon this assumption.

The British experience of nuclear power costs was disastrous, as revealed when the UK electricity industry was privatised. Then the British Government had to impose a Fossil Fuel Levy to subsidise nuclear electricity through the Non-Fossil Fuel Obligation (NFFO). In the 1990s this subsidy peaked at £1.3 billion per year, [3] equivalent to a subsidy of 3 pence for every kWh of nuclear electricity generated (about 6 c/kWh Australian), making the total cost of nuclear power about 6 p/kWh (12 c/kWh Australian). The last British nuclear power station to be built, Sizewell B, ended up with a capital cost of £2500/kW in 2005 British currency (A$5000/kW). [4] This extreme case demonstrates the financial risks involved. As recently as 2003, the British White Paper on Energy stated that "the current economics of nuclear power make it an unattractive option for new generating capacity". [5]

In the USA a pro-nuclear study, *The Future of Nuclear Power*, by an expert group from the Massachusetts Institute of Technology (MIT), ignored much of past US experience and made several optimistic assumptions about future capital and operating costs. With a basic capital cost of US$2000/kW, a capacity factor[6] of 85% and a lifetime of 40 years, it found the estimated cost of electricity from a hypothetical new nuclear power station to be US 6.7 c/kWh[7] (about 9 c/kWh Aust.), increasing to US 7.5 c/kWh (10 c/kWh Aust.) for a capacity factor of 75%. Although the report stated that financing was done under market conditions, the interest rate chosen to repay the debt was surprisingly low at 8% nominal or 5% real, giving an advantage to nuclear power in comparison with fossil fuels, as discussed below. In both the UK and USA it appears that nuclear energy may be more expensive than on-shore wind energy at excellent sites (typically US 4.5-5.5 c/kWh in USA and 3-4 p/kWh in the UK in 2005).[8] Furthermore, Grimson and Beck indicate that the costs of renewable energy are 'generally falling at a more rapid rate than alternatives', given rates of innovation and emerging economies of scale.[9]

Claims by the industry that nuclear energy is cheap in countries other than the UK and USA are often unverifiable bottom-line results or 'justified' by analyses with hidden assumptions that are highly favourable to nuclear power. For example:

- Because nuclear energy has a high capital cost and low operating cost, choosing an unrealistically low interest or discount rate can make nuclear energy look much less expensive. [10] This is illustrated by the comparative electricity generating cost study published jointly by the International Energy Agency and the OECD Nuclear Energy Agency, both widely regarded as pro-nuclear. With a realistic discount rate of 10% real per annum, there were no countries out of 18 studied where nuclear energy was cheaper than either coal or gas. However, when

an unrealistically low 5% real discount rate was chosen, nuclear energy was claimed to be the cheapest in 5 out of 18 countries.[11] Even the results for a 5% discount rate could be over optimistic, because the data are supplied to the OECD by the nuclear industry itself and are not open to objective verification.

- Another means of disguising the high annualised capital cost of nuclear energy is to chose certain accounting methods (such as one based on historical costs) that shrink the capital cost component. This device was used in the UK in the years before electricity industry restructuring.[12]
- Ignoring the huge subsidies from government to nuclear energy also makes the technology look less expensive. Varying from country to country, these subsidies include R & D, uranium enrichment, decommissioning, waste management and limited liabilities for accidents. In the USA subsidies are estimated to have accumulated over the 50-year period 1948 to 1998 to about US$74 billion.[13] In the UK, the Nuclear Decommissioning Authority has estimated that the cost of decommissioning existing nuclear power stations to be about £70 billion. In 2006 a Parliamentary Committee increased this to £90 billion.
- Making over-optimistic assumptions about operational performance as measured by capacity factor of the nuclear power station is another method. Nuclear proponents often choose as typical the year with the highest capacity factor, instead of averaging the capacity factor over the lifetime of the station.
- When comparing coal and nuclear as potential competitors for base-load operation, the nuclear industry often assumes that coal is operated as intermediate-load (i.e. for less time per year) while nuclear is base-load, thus assigning a lower capacity factor to coal. This is obviously inappropriate when considering different energy technologies as competitors for base-load power.

In 2006 the only new nuclear power station under construction in a Western country is currently taking shape in Finland. The nuclear industry claims that this demonstrates that nuclear energy is competitive in under market conditions. But others have pointed out that the power station is being built by a consortium that includes 40% share by the government of Finland and that it will sell its electricity to members of its own consortium. Therefore it will not operate under conditions of a competitive market and so it can obtain finance at interest rates far below market rates.

References:

1 Thomas, S, 2006, The Economics of Nuclear Power, in Anon. (ed), *Nuclear Power: Myth and Reality* (Saxonwold: Heinrich Boll Stiftung)

2 MacKerron G et al. 2006, *Economics of Nuclear Power*. A report to the Sustainable Development Commission. Paper 4 of series, *The role of nuclear power in a low carbon economy*. www.sd-commission.org.uk/publications.php?id=339 (accessed 26/7/06).

3 Mitchell C 2000, The England and Wales fossil fuel obligation: history and lessons. *Ann. Rev. Energy Environ*. 25, 285-311, Table 4.

4 Performance and Innovation Unit (PIU), 2002. *Working Paper on the Economics of Nuclear Power*. The Energy Review, Cabinet Office, Table 1, p.6.

5 Department of Trade and Industry 2003, *Our Energy Future: Creating a low carbon economy*. Section 4.68. www.dti.gov.uk/files/file10719.pdf (accessed 26/7/06.

6 Capacity factor is average power output divided by rated or peak power, expressed as a percentage.

7 Ansolabehere, S et al. 2003, *The Future of Nuclear Power*: An interdisciplinary MIT study. http://web.mit.edu/nuclearpower

8 Diesendorf M 2006, Wind power in Australia. *International Journal of Environmental Studies* (in press).

9 Grimston, M. C. and Beck, P. 2002, Double or Quits: The Global Future of Civil Nuclear Energy (London: Royal Institute of International Affairs) p:66.

10 E.g. choosing 5% real, instead of 10-15% real. ('Real' means 'on top of the inflation rate'.)

11 NEA/IEA 1998, *Projected costs of generating electricity*, Update 1998, Nuclear Energy Agency/International Energy Agency/OECD, Paris. See also summary by the Head of the Economic Analysis Division of the International Energy Agency: Birol F 1999, *Nuclear power in the world energy outlook*, Uranium Institute, 24th Annual International Forum, 1999, www.world-nuclear.org/sym/1999/birol.htm (accessed 20/2/06).

12 Jeffrey, JW 1980, The real cost of nuclear power in the UK. *Energy Policy* 8(4):344-6; Jeffrey, JW 1982, The real cost of nuclear electricity in the UK. *Energy Policy* 10(2):76-100; House of Commons select Committee on Energy 1981, *The Government's Statement on the New Nuclear Power Programme*, HC114-1, HMSO, London.

13 Public Citizen, Energy bill: billions more in taxpayer handouts to the failed nuclear industry. www.citizen.org/documents/NukeSubsidies.pdf (accessed 7/7/06).

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