

The quest for zero-radioactivity nuclear energy

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Many would argue that the original hopes of nuclear power, including “electricity too cheap to meter” can only be realised when useful amounts of energy can be released in a controlled manner from nuclear reactions that yield no radioactive wastes or any other pollutants whatsoever. Even the more familiar thermonuclear fusion reactions yield most of their energy as high-energy neutrons, a consequence being the production of some radioactive wastes.

An added bonus would be for reactions that may be harnessed to yield electricity without resort to thermodynamic (heat-engine) cycles, i.e. to convert the energy released by them directly into electricity.

There are such reactions, but they are exceedingly difficult to initiate. Still, intrepid researchers, often space travel enthusiasts, continue to pursue this dream.

This paper outlines the nature and history of this quest, some of the personalities involved, and hopes for the future, including recent developments that may make the goal tantalisingly close.

Concerns manifest in the Kyoto Protocol over increasing emissions of carbon dioxide from the combustion of fossil fuels are tending to reduce the appeal of coal from its position as the fuel of choice for meeting the projected growth in global electricity demand, likely to see energy requirements double in 25 years and quadruple in 50 years². Natural gas yields less than half as much carbon dioxide per unit of electrical energy sent out, but its appeal is dimmed by concerns over its availability and price over the long term. Large hydroelectric projects are fundamentally constrained by the availability of suitable and otherwise acceptable sites. As for renewables, while wind turbines and solar cells are certainly proliferating it's unrealistic to expect them to be major contributors to electricity supplies in the near term, even though they may well become so by the second half of the century³.

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² WEC Statement 2000, *Energy for Tomorrow's World – Acting Now!* World Energy Council, London 2000, ISBN 1-901640-06-X

³ Hunwick R.J., *The Rational Path to the Age of Renewable Energy*, Australian Institute of Energy, Energy News Vol 20 No. 3 September 2002 pages 291-295. This argues that the sustainable maximum growth rate of any new industry cannot exceed 25-30% per annum. Even with such growth rates renewables will still be producing less than 10 per cent of the world's electricity by 2025, because of their current small installed bases.