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Australia's uranium after Kyoto

With the coming into effect of the Kyoto protocol,[1] the use of nuclear power to reduce greenhouse gas emissions has taken greater prominence in debate. In this context, Australia's large resources of uranium—the feedstock of nuclear power—will become more important. In addition, the growing gap between demand and supply of uranium is driving world prices higher, ultimately to the advantage of Australia's uranium miners.

This brief examines the issues of Australia's uranium in the context of world supply and demand, shows why world prices are rising and looks to the future of the uranium industry in the environmental debate over greenhouse gas emissions.

Australia's uranium

Uranium is a naturally occurring radioactive element which is a mixture of several forms or *isotopes* of uranium. Of these isotopes, uranium-235—referred to symbolically as ^{235}U—is capable of sustaining a *nuclear chain reaction*. This chain reaction can be controlled to release large amounts of energy which can be used to generate heat. The heat energy released is used to drive steam turbines which in turn generate electricity. Although other elements are also capable of sustaining chain reactions, uranium is the cheapest and most abundant. Hence ^{235}U is of importance as a fuel in the nuclear reactors used to produce electricity in a number of countries worldwide.

Uranium ores are processed using acid or alkaline leach technologies to recover uranium concentrates which are bright yellow in colour and referred to as 'yellowcake'. Yellowcake is then heated to about 700°C to produce a dark grey-green powder containing more than 98 per cent uranium oxide—U_3O_8—which is placed in 200-litre steel drums for export.

In its natural state, ^{235}U does not form a high enough proportion for the uranium to be useful as a fuel. This natural occurrence of about 0.7 per cent ^{235}U needs to be increased to as much as 4.0 per cent ^{235}U. Uranium producers in Australia do not attempt this process which needs highly specialised and expensive equipment. This *enrichment* process is carried out overseas using Australian-exported uranium. Eventually the ^{235}U-enriched uranium is used to manufacture fuel rods for nuclear power reactors in countries prepared to sign nuclear safeguards agreements (see below).

Australia's uranium reserves

Australia has the world's largest resources of low-cost uranium (recoverable at costs of less than US$40 per kilogram of uranium), with approximately 39 per cent of world resources in this category. It has 28 per cent of the world's resources recoverable at less than US$80 per kilogram of uranium. This makes Australia significant in this market.

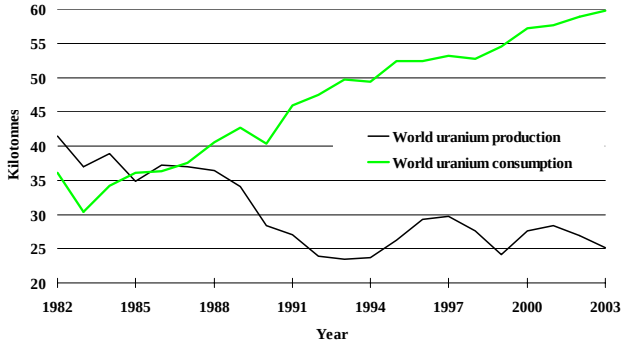
Demand for uranium

Demand for Australia's uranium is ultimately a function of installed nuclear electricity capacity in countries prepared to sign Australia's nuclear safeguards policy. Worldwide there are currently 440 nuclear reactors generating electricity. Their installed capacity is around 350 gigawatts energy which is equivalent to about eight times the total installed capacity of all conventional electricity generation plants in Australia. By the year 2020, it is expected that nuclear power reactors operating worldwide will have an installed electricity generating capacity of between 425 and 500 gigawatts energy.

For some time now, world requirements for uranium have exceeded world production, with a proportion of requirements being met from the conversion of highly enriched uranium from obsolete military warheads. Additional supplies may eventually come from uranium produced in the new states formed after the break up of the Soviet Union; these have not previously been provided to the world market.

Graph 1 shows world production and consumption of uranium since 1982.

Graph 1: World uranium production and consumption 1982 to 2003

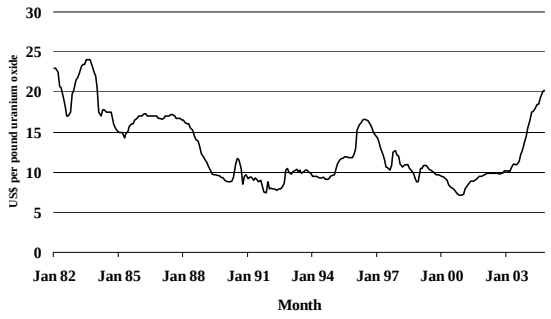


Source: *Australian Commodity Statistics 2004*, ABARE, Tables 343 and 344.

Despite this obvious imbalance and the reduction in stockpiles, world uranium prices have not risen until the last few years. Low prices were due to the world uranium stockpile and the uncertainty of the outcome of political decisions concerning the use of military stockpiles, the de-commissioning of old warheads, and the use of uranium from the states of the ex–Soviet Union.

Graph 2 shows monthly average world uranium spot prices since 1982. Because of the dominance of the USA in the world uranium market, these prices are quoted as $US per pound of U_3O_8. Although Australia's uranium is sold under long-term contract rather than onto the spot market, these spot prices do give an indication of the state of the world uranium market in which future contracts will be written. It is clear from these data that there has been a large increase in uranium spot prices in the past few years. This increase in prices looks set to continue.

Graph 2: Uranium prices January 1982 to October 2004

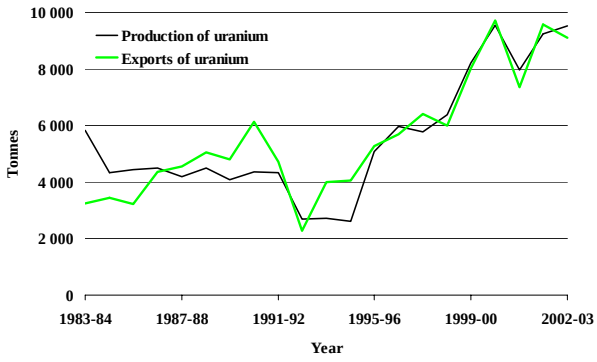


Source: *Australian Commodity Statistics 2004,* ABARE, Table 345.

Australian production and exports

Production of uranium in Australia makes up more than 20 per cent of world production. Production is from three mines: Ranger in the Northern Territory and Olympic Dam and Beverley in South Australia.

Graph 3: Australian production and exports of uranium 1983–84 to 2002–03



Source: *Australian Commodity Statistics 2004,* ABARE, Table 342 as revised following personal correspondence.

Australian production and exports of uranium closely parallel one another. Graph 3 shows that current production and exports are approaching 10 000 tonnes of uranium oxide per year.

All production is exported because there is no significant local demand for uranium oxide. Australia applies conditions to the export of uranium under its nuclear safeguards policy. This policy, which began in 1977, is intended to ensure that Australian uranium is not used for, or diverted to, nuclear weapons programs. In practical terms, this is based primarily on the buyer being a signatory to the Nuclear Non-Proliferation Treaty. In addition, Australia requires buying countries to enter into a bilateral agreement, thereby further ensuring among other things that the uranium is covered by International Atomic Energy Agency safeguards throughout its life; that Australian uranium is only transferred to third parties with Australian consent; and that the uranium is kept physically secure. Australia currently has 18 bilateral safeguards agreements which cover 35 countries. Compliance with Australia's nuclear safeguards policy is monitored by the Australian Safeguards and Non-Proliferation Office.

The future

The future of Australia's uranium industry will ultimately be the outcome of Australian and worldwide concerns about the environmental health dangers of mining and using uranium, of the need to store nuclear fission products for very long periods of time and of the issues concerned with the de-commissioning of nuclear electricity reactors at the end of their useful life. Environmental concerns have led to the closure of nuclear electricity reactors in several countries. Nonetheless, with concerns about the environmental effects of carbon dioxide emissions from coal-fired electricity generation and the uncertain future price of oil, there are considerable pressures to increase the importance of uranium and nuclear electricity generation in the future mix of energy sources.

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1. The date of effect of the Kyoto protocol is 16 February 2005.

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