

# Australia, uranium and nuclear power

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*(Received 3 October 2006)*

The nuclear debate in Australia is shaped by the nation's substantial base of energy resources, including its large reserves of uranium and recent rises in the market price of uranium. But the debate also echoes Australia's past in the development of programs for nuclear weapons. The proposals include uranium enrichment, the storage of nuclear waste in Australia, and the introduction of nuclear reactors. A national inquiry has been instituted by the government. These developments, stemming from a range of factors, have revived the opposition to uranium mining and nuclear power which has for two decades held a dominant role in Australian politics. The issue of what should be Australia's energy path in a time of climate change is beginning to be examined. The importance of the decisions, whether to be a player in the nuclear club with its attendant multiple hazards, or to play a quite different leadership role in the development and adoption of sustainable energy strategies and technologies, cannot be exaggerated.

*Keywords:* Renewable Energy; Australia; Nuclear

## Introduction

Australia once more is becoming embroiled in a debate about its energy future, and in particular, how and to what extent it should engage with the nuclear fuel cycle. This new nuclear debate is preceded by a long history of nuclear activities stretching back to military actions in Australia in the 1950s. In 1952, with the agreement of the Australian Government, the UK tested nuclear weapons, first at Monte Bello (off the West Australian Coast) from 1952 and then at Maralinga (in South Australia) commencing in 1953. At the time when the news of the successful test was announced in Parliament members from all parties are reported to have broken into enthusiastic cries of 'At last, at last!' [1, p. 10]. This theme, that Australia's international standing would be lifted by being a significant actor in relation to nuclear energy, has remained a constant element in developments to the present.

Even before this, Australia had begun its role as quarry for radium and uranium. A small quantity of radium (less than 2 grams) [2] was produced over 1906 to 1932 from newly discovered uranium deposits at Radium Hill and Mt Painter in South Australia [2]. From 1949 to 1954 new uranium deposits were discovered at Rum Jungle, Mt Painter, Radium Hilli and then the South Alligator Valley and Mary Kathleen in Queensland. During 1952,

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contracts were signed and 2350 t of  $U_3O_8$  (uranium oxide) was eventually exported for use in the British and American nuclear weapons programs. Australian production peaked in 1961 at 1338 t  $U_3O_8$  falling to less than a third three years later, with no new contracts in prospect. Whilst small, relative to burgeoning production in the USA, South Africa and Canada, the local production acted as politically important currency for the Australian Government, allowing it to participate in international nuclear negotiations. All mines closed by 1964, while the Government continued to operate Rum Jungle until 1971, stockpiling the uranium.

In the late 1960s an emerging world nuclear industry re-invigorated the mining industry which launched major exploration programs across Australia, with extraordinary success. Over 1969 to 1975 numerous and sometimes large and high grade new uranium deposits were discovered. They included the Ranger, Koongarra, Nabarlek and Jabiluka deposits in the remote Alligator Rivers Region east of Darwin, the Beverley and Honeymoon deposits in South Australia, and numerous deposits at Yeelirrie, Lake Way and Lake Maitland in central Western Australia (see figure 1). Rich in grade (around 0.3%  $U_3O_8$ ), and large in contained uranium, they provided a strong basis for entering the commercial uranium industry.



Figure 1 Uranium resources, current and former mines and nuclear sites in Australia.

During the same period, however, the growing nuclear industry overseas provoked a wave of citizen concern which swept across much of the developed world. The growth of concern caused the Swedish government to fall, stopped national nuclear programs in their tracks (e.g. UK, USA), and played a role in forcing increasing safety precautions which contributed to the rapid rise in the cost of nuclear reactors [3, pp. 61–89]. In Australia, a similar movement developed, with large demonstrations in major cities [3]. The focus was not so much on any immediate prospect of nuclear reactors in Australia, but more on the contribution that Australia might make to the development of nuclear hazards, including the increasing risk of nuclear war, overseas. In the mid-1970s this opposition became so intense that the Labor Party government of the day (which owned a 50% stake in the Ranger mine, and had already signed related contracts) felt impelled to institute an Inquiry into the issues [3]. Six months later the government was suddenly and unexpectedly removed from office. The conservative Fraser Government who replaced it nevertheless continued the Inquiry.

The Ranger Uranium Environmental Inquiry (RUEI) heard evidence on the many issues associated with the nuclear fuel cycle, from the unresolved issue of how to dispose of high-level waste, to the complex issues of nuclear weapons proliferation. The Inquiry also heard evidence on the poor environmental history of uranium mining in Australia; most notably the effects at Rum Jungle of lack of adequate waste management practices which had seen the disposal of uranium mill tailings and acidic liquid effluents onto the adjacent floodplain of the East Finnis River, heavily polluting it for some 20 km downstream and affecting a total area of 100 km<sup>2</sup> [4,5]. It also heard testimony by Aboriginal elders that the mining would undermine their spiritual and physical association with their land.

The report of the Inquiry considered all these issues. In relation to Aboriginal concerns, it was dismissive, concluding that, on balance, ‘they should be set aside’. Its main emphasis was on the global nuclear fuel cycle. In particular it stressed that the nuclear industry was ‘inadvertently contributing to an increased risk of nuclear war’, and that because of the ‘hazards, dangers and problems associated with the production of nuclear energy’, Australia should ‘seek to limit or restrict expansion of that production’ [6]. Nevertheless, rather than make explicit recommendations it concluded that as many of the questions are ‘social and ethical’, ‘the final decisions should rest with the ordinary man’ [6, p. 186].

Despite the continued opposition of a large sector of the community, the Ranger project was approved in 1979 and produced its first uranium in 1981. The Nabarlek deposit was mined in 1979 and milled from 1980 to 1988. The giant Olympic Dam deposit, containing copper, uranium, gold and silver, began commercial production in 1988 after extended political controversy and community protest. The Hawke (Labor) Government, which was elected in 1983, responding to a slow market and community concerns, banned the development of new uranium mines. Despite Australia by then having some of the lowest cost uranium deposits in the western world, production was confined to 3000 to 5000 t U<sub>3</sub>O<sub>8</sub> per year in the 1980s.

It was not until 1996 that, with the election of the conservative (Liberal and National Party) Howard Government, that there was a re-kindling of interest in uranium by miners. The mining industry focused in particular on specific deposits such as the substantial Jabiluka deposit, Beverley and Honeymoon. By the late 1990s the mills at Ranger and Olympic Dam had been expanded and the Beverley acid leach project had been approved. But the uranium price had collapsed. A stagnant nuclear power industry, the release of more highly enriched uranium for down-blending from decommissioned nuclear weapons, and the existence of large utility stockpiles dampened commercial interest in expansion.

## Uranium futures

The world price of uranium oxide has recently begun to move upward, from a historically real-term low of US\$7.10/lb  $U_3O_8$  in late 2000 to recent highs of about US\$40/lb  $U_3O_8$ . In concert, over the last year there has been a surge of interest in uranium exploration and development. The excitement has been fed by the perceived possibility that nuclear power might be able to make a comeback assisted by the threat of climate change and need to reduce carbon emissions.

Based on the most recent OECD-IAEA assessment, Australia has approximately 25% of the world's economic uranium resources (as of 1 January 2005), or some 1,350,000 t  $U_3O_8$  compared to global resources of 5,590,000 t  $U_3O_8$  (based on all resources in the 'Reasonably Assured Resources [RAR]' and 'Inferred' [formerly Estimated Additional Resources]' categories [7]). But, this only takes partial account of the potential of the Olympic Dam deposit which contains some 1,500,000 t  $U_3O_8$  (as of 30 June 2005) [8] (the OECD data most likely only include a resource figure for Olympic Dam of ~880 kt  $U_3O_8$ ). A summary of the principal uranium deposits in Australia is shown in table 1 below, indicating a total known resource of approximately 1,950,000 t  $U_3O_8$ .

Future uranium production in Australia will be derived from progressively lower grade ores, including Ranger, but dominated by possible future expansions at Olympic Dam. A major challenge associated with future milling is that of the refractory nature of the uranium minerals in the ore which, at Olympic Dam or potential projects such as Valhalla and Yeelirrie, will necessitate more aggressive milling to extract the uranium. The true costs of this problem are yet to be fully realized or assessed, especially in terms of greenhouse emissions from uranium mining and milling. Based on reported environmental data for Ranger and Olympic Dam [9–11], the resource intensity per unit uranium produced is increasing over time for both Ranger and Olympic Dam. Energy consumption and greenhouse gas emissions will increase in parallel (currently, the energy cost of uranium production at Beverley and Ranger is 155 to 200 GJ/t  $U_3O_8$ ) [9, 10, 12, 13].

The future export of Australian uranium is often linked to increases in demand from potential nuclear power markets in India and China. OECD assessments suggest that the economically

Table 1. Major Australian uranium deposits.

Deposit /	Ore	Grade	Cutoff	Contained $U_3O_8$	Date	Reference
Resource	Mt	% $U_3O_8$	% $U_3O_8$	t $U_3O_8$		
Olympic Dam	3970	0.04	-	~1,500,000	June 2005	[40]
Ranger	52.96	0.16	0.08	84,700	Dec. 2005	[42]
Beverley	12	0.18	0.03	21,400	1997	[44]
Jabiluka 2	34.07	0.48	0.2	164,000	Dec. 2005	[42]
Koongarra 1	3.453	0.44	0.02	15,200	~1990	[46]
Koongarra 2	~0.8	~0.3	-	~2000	~1990	[50]
Honeymoon-East Kalkaroo	4.0	~0.11	0.01	4210	2004	[49]
Westmoreland	17.4	0.12	-	20,900	~1997	[48]
Valhalla Field	37.8	0.085	0.023	32,350	~2001	[51]
Yeelirrie	35.2	0.15	0.05	53,000	~1990	[41]
Kintyre	~14	0.15-0.4	-	36,000	~1990	[45]
Mulga Rock	10.8	0.12	0.03	13,000	~1990	[43]
Manyingee	12.1	0.08	-	10,890	2005	[47]

recoverable uranium resources of India and China are 76,000 and 70,000 t U<sub>3</sub>O<sub>8</sub> respectively (based on all resources in the 'Reasonably Assured Resources [RAR]' and 'Inferred' [formerly Estimated Additional Resources] categories [7]). It seems likely that if India and China buy uranium on the international market they will be preserving their relatively small indigenous uranium resources for use in their national nuclear weapons programs. As the Chinese Ambassador, Madame Fu, said recently 'As China ramps up its power capacity it is aiming to double the proportion sourced from nuclear energy to 4 per cent by 2010' and 'while it has enough uranium resources to support its nuclear weapons program it would need to import uranium to meet its power demands' [14]

### **A renewed Australian nuclear energy debate**

Up to 2004, apart from some isolated episodes of political 'kite flying', there had been no serious proposals to develop an Australian nuclear power industry since a proposal to build a reactor at Jervis Bay was cancelled in the early 1970s. (The project is reported to have reflected an interest by the then Prime Minister, Sir John Gorton in nuclear weapons [15].) In 1998 the Federal Government listed nuclear power as a proscribed activity under the Australian Radiation Protection and Nuclear Safety Act 1998. (Four state governments and the Northern Territory also passed Prohibition Acts making a range of nuclear activities illegal in their domains [16].) Commonwealth and state governments have significant responsibilities for uranium mining. In general, aspects such as electricity and waste management are state responsibilities, controlled by state legislation. The Commonwealth (Federal) sphere is principally concerned with consistency and national standards as well as performance with respect to international treaties and the like. A decision to pursue new nuclear projects such as enrichment or a power reactor would necessarily involve the Commonwealth government as 'nuclear actions' are listed as 'matters of National Environmental Significance' under the Environment Protection and Biodiversity Conservation Act 1999.

Consistent with the above stances, in 2004, the Federal Government's White Paper, 'Securing Australia's Energy Future', noted that: 'While industrialized countries on average generate 24 per cent of electricity from nuclear power, Australia is not contemplating the domestic use of nuclear power' [17].

Nevertheless, the period 2003–2004 also marked the commencement of the rise in the price of uranium with corresponding growth in uranium exploration and speculation. At the same time supporters of nuclear power sought to promote nuclear power as a 'solution' to climate change.

Responding to this increasing pressure the Federal Government, in March 2005, asked the House of Representatives' Standing Committee on Industry and Resources to initiate an inquiry into the uranium mining and export industry [18]. A request from the Committee to have its terms of reference expanded to include nuclear power was rejected by the government. Likewise, a November 2005 proposal for a A\$1 million study on the viability of a domestic nuclear power industry, put to the Prime Minister by the then federal Science Minister, Brendan Nelson, and the Industry Minister, Ian Macfarlane, attracted little interest and no funding.

Nevertheless, the nuclear debate has gathered momentum, the side advocating expanded nuclear activities being driven by an eclectic, loose coalition including some politicians, a section of the corporate media (in particular the Murdoch press), nuclear lobby groups such

as the Australian Nuclear Association and the Uranium Information Centre, and a small number of academics. There are recurring claims that environmentalists are turning in support of nuclear power although there is little evidence to support the proposition. James Lovelock is the most commonly cited pro-nuclear environmentalist, along with an ex-Greenpeace founding member, Patrick Moore (now funded by the Nuclear Energy Institute to co-chair the so-called Clean and Safe Energy Coalition).

A research consultancy, Future Directions International, has taken credit for kick-starting the nuclear debate in Australia with its October 2005 report, 'Australia's Energy Options' [19]. The report costs \$1500 to obtain and it is difficult to ascertain how influential it has been. The Future Directions International website says that 'strong financial and other support' has been obtained from the Commonwealth and Western Australian governments, and that the federal departments of Foreign Affairs and Trade, and Defence, have both seconded staff [20].

In May 2006 it appears that domestic pressures, and political opportunity, have combined once more with the international allure of being able to play a role in the 'nuclear club'. During the Prime Minister's visit to the United States, Mr Howard discussed nuclear issues with the US President and government officials. The substance of these discussions has not been released, despite a request, under the Commonwealth of Australia Freedom of Information Act 1982 from *The Age* newspaper.

Suggesting that matters of national security may well have been involved, the government will not even reveal with whom the Washington nuclear discussions were held. The Department of Prime Minister and Cabinet's assistant secretary, Allaster Cox, wrote in a letter to *The Age* that the information would not be released because: 'The conversations concern nuclear power and uranium, which are issues of key strategic importance for the parties involved in the conversations ... The conversations were conducted at the highest levels of government, which suggests that any conversations about nuclear power and uranium would be sensitive' [21].

### **The Uranium mining processing and nuclear energy review**

On 6 June 2006, the Commonwealth government initiated a relatively broad-ranging inquiry — the Uranium Mining Processing and Nuclear Energy Review (UMPNER) — to investigate potential Australian involvement in all aspects of the (civil) nuclear fuel cycle. It will cover uranium mining, conversion and enrichment, nuclear power, reprocessing and the 'business case' for Australia hosting an international nuclear waste repository [22].

The government-appointed panel is widely seen to represent pro-nuclear interests. It has been asked to conclude its review within six months. Its terms of reference are very restricted. It contains no specific reference to past or projected impacts of uranium mining on Aboriginal communities, and the serious social impacts of an expanded nuclear fuel cycle, but focuses on nuclear power rather than the comparative advantages and disbenefits of different energy paths.

Nevertheless, the Inquiry indicates a turning point. A renewed nuclear debate has begun, which now extends well beyond uranium mining to consideration of other possible nuclear fuel cycle developments in Australia. These range from uranium conversion and enrichment, to fuel fabrication, nuclear power, reprocessing and the option of hosting an international nuclear waste repository.

## **GNEP**

The Prime Minister has acknowledged that the decision to establish the UMPNER inquiry has been motivated in large part by overseas developments, in particular the Global Nuclear Energy Partnership (GNEP).

The GNEP is a proposed partnership between the five declared nuclear weapons states — the US, UK, China, France and Russia — and Japan. Led by the US, the GNEP is in its formative stages. The plan is for supplier nations to undertake to provide nuclear fuel on a ‘cradle-to-grave’ basis with provision to receive spent fuel. This is intended to limit the spread of enrichment and reprocessing technology and limit the number of nation states with stockpiles of plutonium (whether separated or contained in spent fuel).

There is clearly some concern within the federal government that the GNEP could limit Australia’s future options. As the Prime Minister said in early July: ‘I think it [GNEP] further focuses our attention, concentrates our mind. If we were to decide in the not too distant future that it would be a good idea to process uranium or to keep open that possibility, that would obviously have relevance to GNEP. The fact this is being developed is a reason why we should look more closely at whether we should process uranium’ [23].

The GNEP proposal is one of a number of similar proposals being developed including a recent proposal canvassed at the 17 July G8 meeting in St Petersburg, by the President of the Russian Federation, for multinational centres to provide nuclear fuel cycle services and ‘a concept for a multilateral mechanism for reliable access to enrichment services for nuclear fuel’ [24].

## **The potential of nuclear fuel leasing**

Complementing those global initiatives is the work of the Nuclear Fuel Leasing Group. Little information is available about the group, although its head, Dr John White, has advocated establishing, in South Australia, a fuel fabrication plant, and an international nuclear waste repository. The Adelaide-Darwin rail line is already used to transport yellowcake and could also be used to transport nuclear waste. BHP Billiton’s Roxby Downs (Olympic Dam) uranium mine in South Australia has by far the greatest uranium reserves of any mine in the world, and it is expected to produce more uranium annually than any mine if a proposed expansion goes to plan.

In addition to his role with the Nuclear Fuel Leasing Group, John White is chair of the Uranium Industry Framework (UIF), established by Ian Macfarlane, Federal Minister for Industry, Tourism and Resources in August 2005. It includes representatives of federal, state and territory governments, mining companies, and the Northern Land Council (an Aboriginal organisation based in the Northern Territory).

The objective of the UIF is ‘to identify opportunities for, and impediments to, the sustainable development of the Australian uranium mining industry’ [25]. It will present an ‘Action Plan’ to the government in the second half of 2006.

The UIF has taken an expansive view of its terms of reference. Media reports based on a draft report of the UIF’s stewardship working group state that it will recommend Australia adopt a policy of receiving and disposing of nuclear waste [26]. The draft report is said to outline a timetable to develop a business case by early 2007, a stewardship plan by December 2007 and endorsement by government and industry by May 2008. That timeline is, to say the

least, optimistic. For comparison, the Federal Government spent six years attempting to impose a national radioactive waste dump on South Australia from 1998 to 2004, but abandoned the proposal in the face of strong opposition from the South Australian public and the state government.

### **A world nuclear waste repository?**

Given the existing high level of public consciousness about nuclear fuel-cycle hazards, proposals for a nuclear waste repository in Australia, which accepts waste from overseas, will face fierce political and public opposition in Australia. Windscale (now named Sellafield) in the northwest of England has assumed the status of 'a nuclear dustbin'. Whether 'dustbin', 'dump', or 'repository', it still represents the same thing to objectors. Whilst the Australian Labor Party's opposition to the development of any more uranium mines is under serious challenge within the party, the ALP has opposed expansion into any other aspects of the nuclear fuel cycle.

An international consortium, Pangea, backed by British Nuclear Fuels and Swiss and Canadian nuclear interests, has attempted to develop an international nuclear waste repository since 1998. In 2000, after spending \$15 million on its Australian activities, Pangea was closed. A number of individuals involved then formed ARIUS — the Association for Regional and International Underground Storage [27]. While ARIUS does not have offices in Australia, its representatives have occasionally continued to promote the idea of establishing a nuclear dump in Australia. While the Liberal/National Coalition government maintains its policy of opposing such proposals, Coalition Senators refused to support a Senate motion opposing an international nuclear dump in May 2006.

Some proponents argue that Australia, as a major supplier of uranium, has a moral responsibility to store the resulting nuclear reactor wastes (on the premise that deep geological management is the best approach for such wastes, and the assumption that appropriate sites exist in Australia). Were Australia to accede to this argument the effect might well be to tuck the nuclear waste issue 'out of sight, out of mind', allowing countries using nuclear power reactors to evade their responsibilities including avoiding resolving the question of whether deep geological storage is indeed appropriate.

Others argue that as only a tiny minority of Australians are involved in, and benefit from, the uranium mining industry, ought not the responsibility lie with this minority? For indigenous (Aboriginal) communities, this moral argument is potentially perverse. Its consequence might well be to force upon them the wastes from the use of uranium in reactors, when they opposed the mining in the first place. Originally deeply concerned over the Ranger project, the Mirarr people have had to deal with the reality of major social impacts from mining activities over the past 35 years. This has increased their opposition to the point where they have resolutely withstood enormous pressure, have blocked mining of the Jabiluka uranium deposit, and signed an agreement with the company that gives them a veto over any future development.

There remain serious environmental and public health risks associated with high-level nuclear waste. As Professor John Veevers from Macquarie University wrote in the *Australian Geologist* in August 1999, at the time of the Pangea ambitions, such a dump would pose serious public health and environmental risks: '[T]onnes of enormously dangerous radioactive waste in the northern hemisphere, 20,000 kms from its destined dump in Australia where it must remain intact for at least 10,000 years. These magnitudes ... of tonnage, lethality, distance of transport, and time ... entail great inherent risk' [28].



A problem for the nuclear lobby is that continuing debate over an international waste repository threatens to strengthen opposition to uranium mining. The Western Australian Labor Premier, Alan Carpenter, for example, has repeatedly argued that the WA Labor government will not allow uranium mining because of the possibility that it would increase pressure on WA to accept an international repository.

The debate over an international repository is certain to continue because of the intractable nature of the nuclear waste issue globally. About 250,000 tonnes of spent nuclear fuel have been generated in power reactors around the world, yet there is not a single operating permanent repository to manage any of this waste [29].

According to the industry-funded Uranium Information Centre: 'Safe methods for the final disposal of high-level waste are technically proven; the international consensus is that this should be deep geological disposal' [30]. But, it can hardly be claimed that deep geological disposal of high-level waste is 'proven' when no such repositories have ever existed. Indeed, the industry claim that there is an 'international consensus' in favour of deep geological management is arguably an acknowledgement that technical fixes such as transmutation will not be available for decades, if ever.

### **Uranium enrichment and 'the elephant in the room'**

Within Australia, it seems likely that if Australia's involvement in the nuclear fuel cycle is increased, it will be with the development of an enrichment industry. The Prime Minister is already pressing forward the idea, emphasizing the benefits of value-adding to raw exports. He said on ABC television in May 2006: 'For decades, we've lamented that we sent wool to Manchester to have it processed. Now I don't want a modern-day version of that' [31].

There are a range of serious issues associated with enrichment, of which the profitability (of which there is no assurance) is only one. An enrichment plant would produce depleted uranium waste with attendant environmental risks. It would also consume large quantities of electricity which would add to Australia's greenhouse emissions and could also increase the pressure for construction of nuclear reactors.

Whilst it would undoubtedly be under the scrutiny of the IAEA, an enrichment plant could give Australia the capacity to produce both low enriched uranium for reactors but also highly-enriched uranium should it in the future wish to move towards a nuclear military capability. *Bulletin* columnist Max Walsh refers to this as the 'elephant in the room' — the possibility that the nuclear debate is being driven by the military potential [32]. Whilst there is no concrete evidence to support the hypothesis, as Walsh notes, the Prime Minister 'will phrase the terms of reference for the nuclear debate in such a way that the elephant in the room remains unmentioned.'

Whilst the declared position of the government in promoting nuclear power is that it is motivated by concern over climate change, this seems unconvincing given that the government has shown little interest in other climate change abatement measures [33]. Similarly, claims that nuclear power would provide energy security lack credibility given that Australia is endowed with a wider range of energy choices than any other nation — vast fossil fuel reserves, excellent potential to expand renewable energy, and enormous scope to implement energy efficiency and conservation measures.

Security considerations may include the recently revived plans in Indonesia to build nuclear power plants. These would result in the production of plutonium which could be extracted

from spent fuel for use in nuclear weapons. A related concern is that the international non-proliferation regime may collapse, because of the recalcitrance of the major nuclear weapons states to dismantle their nuclear weapons and the ambitions of would-be weapons states. As the 2004 report of the UN Secretary-General's High Level Panel on Threats, Challenges and Change noted: 'We are approaching a point at which the erosion of the non-proliferation regime could become irreversible and result in a cascade of proliferation' [34].

Whatever the actual contribution of such security considerations, there can be little doubt that an enrichment plant would bolster the long-standing aspiration by successive Australian governments to establish a prominent international role for Australia through engagement with the 'nuclear club'.

Achieving this requires Australia to be seen as 'a responsible player', adding to nuclear stability by expanding its nuclear activities. But, the strategy may be opposed by the US and other nations involved in the Global Nuclear Energy Partnership if it is seen to undermine efforts to stem the proliferation of sensitive nuclear facilities.

Certainly Australian opposition to uranium enrichment programs in Iran and North Korea would be undermined by developing its own capacity. Likewise, Australia could not credibly oppose other countries in the Asia Pacific region wanting to develop the capacity to produce fissile material under the guise of a peaceful program. This is a problem which bears on Australia's security in more ways than one.

### **The NIMBY factor**

In terms of expansion of the nuclear fuel cycle in Australia, an enrichment plant seems the most politically tractable. In particular, the siting criteria for an enrichment plant are more flexible than for a power reactor. An enrichment plant could be built, for example, in a remote area of South Australia, whereas a power reactor would need to be closer to a major water source (for cooling) and closer to a population centre and transmission lines (unless the reactor was providing power for a water desalination plant or, indeed, for a uranium enrichment plant).

In May 2006, the Australia Institute, a progressive think-tank, applied standard power reactor siting criteria to Australia and set off a media fire-storm by announcing likely locations such as Westernport Bay in Victoria and Port Stephens in NSW [35]. As might be expected, this helped focus attention on the many local impacts associated with a reactor.

The Australia Institute has been criticized for its siting study by the Federal Government who prefer to keep the debate on nuclear power at an abstract level. The government has generally promoted nuclear power as something possibly for the long-term rather than a short-term option. Thus the terms of reference for the UMPNER inquiry ask the panel to consider the 'extent and circumstances in which nuclear energy could in the longer term be economically competitive in Australia with other existing electricity generation technologies'. It is, however, doubtful politically that this convenient level of abstraction will be allowed to be maintained.

### **Nuclear power and greenhouse gas emissions**

The debate in Australia has yet to engage with the real issue: which energy options can and should Australia select in the face of changing energy developments internationally, and climate change.

Nevertheless, some valuable work has been completed. For example, the Australian Ministerial Council on Energy has identified that energy consumption in the manufacturing, commercial and residential sectors could be reduced by 20–30% with the adoption of current commercially available technologies with an average payback of four years [36].

The most comprehensive work so far is in two detailed studies, one by the Australia Institute, and the other by the Clean Energy Future Group. Both studies develop credible future energy paths for Australia that make deep cuts in greenhouse gas emissions, allow for steady growth in the national economy, and avoid any use of nuclear power.

The 164-page Clean Energy Future Group study shows how Australia can achieve a 2% per annum annual economic growth from 2001 to 2040 together with population growth to 25 million people, whilst simultaneously reducing greenhouse gas emissions from the stationary energy sector by 50% by 2040 compared to emissions in 2001. Both studies include a sectoral analysis, significant investment in energy efficiency measures in all sectors, and the use of natural gas and cogeneration as a bridge to phasing in renewable energy technologies. Both studies are conservative in that they rely upon currently proven technologies with projected unit prices in 2050 no greater than the energy prices which currently prevail in Western Europe [37]. A further study by WWF Australia, published earlier this year, shows how the electricity sector could reduce greenhouse emissions by 40% by 2030 at modest cost [38].

## Conclusion

A determined effort to expand nuclear fuel cycle activities has begun in Australia. Led by initiatives of the uranium mining industry it has the enthusiastic support of the Federal Government. The proponents' arguments are couched in the language of concern over global warming, whilst focusing on the potential profits from expanded uranium mining and the possibility of enhanced value adding from uranium enrichment. As the debate progresses, other motives of government have surfaced, including the international status which Australia could achieve by closer integration with the major nuclear powers through increased nuclear activity.

The opposition to uranium mining and nuclear power remains a serious obstacle to these plans. A May 2006 Newspoll survey of 1200 Australians found that some 66% are opposed to the establishment of any new uranium mines in Australia with only 22% in favour. It found that 51% oppose the introduction of nuclear power to Australia with only 38% in favour [39].

The campaign for nuclear expansion has provoked serious debate. That will only reach maturity when it also embraces in a systematic way what the energy alternatives are for Australia. For Australians, the choice remains, either to be a player in the nuclear club with its attendant multiple hazards, or to play a quite different leadership role in the development and adoption of sustainable energy strategies and technologies. If the previous debate over uranium mining of the 1970s is any guide, Australians are capable of rising to the occasion, and opting for the more benign and creative of these two options.

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