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# Demand for uranium

Second in the series on the *Debate on Nuclear  
Policy in Australia, 2005-2006*

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## Abstract

Projections about future demand for uranium and uptake of nuclear power are the basis of some of the most contentious, and most often quoted, claims aired in current debates on nuclear policy. This paper looks at characteristic arguments put forward by nuclear proponents and opponents, showing their strengths, shortcomings, and implications.

## Table of Contents

Introduction.....	4
For .....	4
Against.....	7
Correspondences .....	10
Discussion .....	11
Conclusion.....	12
References .....	13

## Introduction

This is the second in a series of seven papers on the debate on nuclear policy in Australia over 2005-2006. Initially prompted by two federal government interventions into Territory matters — to take control of uranium mining in the Territory, and to establish a National Radioactive Waste Facility there — this series now considers arguments on another important matter: whether Australia should use nuclear power for its own energy requirements.

This paper is structured under headings 'For' and 'Against', representing arguments made for the affirmative case — that uranium mining should expand — or the negative case — that it should not — offered by nuclear proponents or opponents respectively. Where sources do not provide sufficient information to form a full argument, other documents are brought into play. All of the papers are based on analysis of submissions to the House of Representatives Standing Committee on Industry and Resources' *Inquiry into the Strategic Importance of Australia's Uranium Resources*, which is part of a broader *Inquiry into developing Australia's non-fossil fuel energy industry* (House Standing Committee on Industry and Resources, 2005). These submissions are offered as being representative of positions on the nuclear debate taken up in the public domain. A further section — *Correspondences* — shows, using press sources, that views expressed in the submissions are consistent with those voiced in the wider community.

Within these opinions we see some surprising differences in perspective as to the current and future fortunes of nuclear industries, particularly on the state of nuclear power generation. These are significant questions for future levels of demand for uranium: are we seeing a long-term rise in demand for uranium, with sustainable prices, from an expanding nuclear power industry or, conversely, is demand trending downwards because new nuclear plants are not being built at a sufficient rate to offset natural attrition? Both positions are arguable, and close consideration is needed to clarify this exchange.

## For

There is a high degree of consistency amongst documents that seek to promote uranium mining and nuclear power generation worldwide, and the submissions that are considered here arguing the affirmative case — by the Uranium Information Centre (UIC), Commonwealth Scientific Industrial and Research Organisation (CSIRO), and the Australian Nuclear Science and Technology Organisation (ANSTO) — are all consistent with that broader position (Uranium Information Centre, 2005a; CSIRO, 2005; ANSTO, 2005). This paper presents the UIC's submission as a representative expression of this strand of sentiment, with supporting references to other affirmative submissions and to other documents.<sup>1</sup>

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<sup>1</sup> The Uranium Information Centre is an industry body: for a list of members, see Uranium Information Centre, 2005b, pp.50-51.

The UIC's submission presents a picture of upward-trending demand and general market prosperity worldwide. However, the UIC's message is not all good news: its also draws on negative messages — particularly a sense of threat over market share — to argue for a need for more vigorous activity in Australian uranium mining. This is essentially a two-part argument that establishes positive and negative features, and orchestrates them to make the case that conditions governing Australian uranium mining should be liberalised.

The UIC uses two initial propositions to support the positive side of its argument. The first invokes price as an indicator of demand for uranium ore. In this view, rising prices for uranium ore are an unambiguous signal of industry health and its future prospects and, indeed, it is true that the spot price of uranium ore — that is the price on the open market outside of long-term contracts or other constraints — has doubled since 2001 to \$US 30/lb (van Wyngen, 2005, p.18). As a result, the effective value of Australian uranium reserves has also increased, with a commensurate rise in interest in realising on investments —through exploration activity and possession of mining leases — by mining companies. The second proposition speaks to the health of the domestic uranium industry by indicating trends in current Australian production, which has risen 'from 4377 tonnes U3O8 in 1995 to 10,964 tonnes in 2004-05'; to its relative scale — accounting for '22% of world production'; and net worth, representing 'exports of A\$ 475 million' (Uranium Information Centre, 2005a, unpaginated).

The UIC's negative arguments are twofold. The first is that Australia has a disproportionately small share of the world market in relation to its percentage of the world uranium reserves. This situation, it is said, poses a threat to Australia's prosperity through a sacrifice of market-share:

Australia has about 30% of the world's low-cost uranium resources but in 1996 only produced about 14% of mine output. This has since increased to 19%. Canada has expanded its production to more than 30% of the world mine output, on a lower resource base' (Uranium Information Centre, 2005a).

The argument is that if Australia does not increase production in line with the proportion of world reserves it holds, it will sacrifice market share now and into the future, as Canada and other competitors move ahead:

Canada has less than half of the reserves of Australia but its annual production of uranium oxide has been substantially higher. Kazakhstan has larger reserves than Canada and has said that it is aiming for a fourfold mine production increase (Uranium Information Centre, 2005b, p.9).

These effects would be made more dramatic by the terms of sale offered by competitors, specifically 'Canadian producers', who 'are vigorously expanding their production capacity [and will] lock buyers into long-term contracts which will constrain the market for the next decade or more' (Uranium Information Centre, 2005a).

A second component of the UIC's negative argument portrays future scenarios in which world demand for uranium ore outstrips supply — unless uranium production substantially increases. This is a prospective 'nuclear energy crisis', in which demand grows from present levels of

80,600 tonnes per year, to 88,200 in 2010, and 97,000 tonnes in 2020 (Uranium Information Centre, 2005b, p.8).<sup>2</sup> The key factor in this dynamic is the reduction in 'secondary supplies, (that is, from decommissioned nuclear weapons which now meet about 41% of demand)', so that 'primary uranium production will need to rise sharply' (Uranium Information Centre, 2005b, p.8).<sup>3</sup> By these calculations, a sizeable increase in production will become necessary between 2004 and 2020, to the extent that 'primary production ... will have to rise by ... 80% to meet demand' (Uranium Information Centre, 2005b, p.8).<sup>4</sup> Under these conditions, Australia's role is to help the world with its energy predicament:

Australia is well positioned to take advantage of the expected growth in demand for uranium and the expected increase in uranium prices. Australia has about one third of the world's economically recoverable resources of uranium. Seven of the top twenty known uranium deposits in the world are in Australia. (Uranium Information Centre, 2005b, p.8).

However Australia could again miss out on market share, failing to 'take advantage of positive trends if it allows the present level of anti-uranium policies, which are presently sterilizing much of the resource base, to stay in place'. (Uranium Information Centre, 2005b, p.8).

All projections on levels of demand for uranium are, clearly, linked in the strongest possible way to what happens in the domain of nuclear power generation: the number of nuclear power plants in operation — at what level of their operating capacity, and at what stage of their operating life — and whether there are prospects of new plants being constructed. On this front, nuclear proponents open their case by citing the relative proportions of electricity produced by differing power-generating technologies. In this, the UIC rates nuclear power generation as accounting for 17% of outputs worldwide — as against coal at 39%, hydro-electric at 16%, natural gas at 19% and renewables at 2%.<sup>5</sup> The argument is: that nuclear power generation makes a significant contribution to worldwide electricity generation, at a level comparable to other mainstream sources with the exception of coal. With coal under pressure as a long-term option, as a major contributor to global warming, proponents argue that nuclear power generation is ready to come into play as a mainstream energy option.

Indeed, in the UIC's account, other countries are already responding to this situation: China, for example, has plans to develop a number of nuclear power plants, to meet projected increases in energy demand over coming decades. Under these arrangements, China's nuclear power capacity will 'more than quadruple to 40 GWe', thus obviating 'the need to mine an additional 17 million tonnes per year of coal' (Uranium Information Centre, 2005b, p.12). Indeed, out of a total of seventy nuclear power plants claimed by the UIC as either proposed or being built worldwide, most are intended for Asia (Uranium Information Centre, 2005b, p.7).

<sup>2</sup> Here the UIC quotes the World Nuclear Association

<sup>3</sup> Here the UIC quotes Graul, 2003, pp.3, 4.

<sup>4</sup> See also CSIRO, 2005, p.6.

<sup>5</sup> OECD/IEA, 2004, cited in Uranium Information Centre, 2005b, p.7.

The industry view of the state of play — stated here largely on the basis of the UIC's submission — is that, worldwide, nuclear power is very much a going concern. Given the proportion of energy it generates in relation to other power generation technologies, and taking an expanded role as coal becomes less attractive as an energy source due to concerns about climate change, nuclear power will be a significant player in electricity generation into the future. This is consistent with other arguments for the affirmative case, such as those offered in CSIRO's submission to the same inquiry (CSIRO, 2005, p.6), and the logical consequence, from this perspective, is a reliably expanding market for supplies of nuclear fuel, with consequent opportunities for Australia as a uranium exporter.

We have seen how nuclear proponents use a combination of positive and negative arguments with a view to encouraging a more liberal climate for the exploitation of uranium reserves. It is less certain how consistent these arguments are when used together: 'are we in good or bad times?' one might reasonably ask. Is Australia's market share the most significant problem, or a worldwide shortage of uranium? Moreover, does Australia need to ensure its share of the market or — conversely — will our uranium save the world from an energy crisis? On the face of it — at least — there appear to be contradictions that require further consideration. In addition, projections as to future levels of demand may be vulnerable to the kind of market-place excitement that can, at times, be generated around particular industries. Given that even recent history shows us that these enthusiasms are not always built on hard data, it would seem wise to ensure that any calculations done on the costs and benefits of increased uranium mining be based on something more than market sentiment alone.

## Against

In canvassing the affirmative case on uranium demand, we have looked at arguments made by the UIC and, to a lesser extent, ANSTO and CSIRO. Here we look at the responding arguments made by Friends of the Earth (FoE), the Medical Association for the Prevention of War (MAPW), and the former Australian diplomat, Richard Broinowski, a recognised commentator on nuclear policy.

We have seen that one of the key strategies adopted by Australian nuclear proponents is to portray uranium mining as a significant contributor to the mainstream economy. These perceptions do, in fact, matter: the more significant uranium mining is seen to be within the mainstream economy, the greater its chances of achieving acceptance from the Australian electorate. If, on the other hand, it is considered more marginal, it must be more vulnerable to public rejection, censure and constraint. And, indeed, this is a valid connection: if it is a matter of balancing positive and negative effects of an expanded nuclear industry, the public must consider whether the industry's contribution is of a sufficient order to offset its negative consequences.

Nuclear opponents take quite a different view of the size and significance of uranium mining to that described by proponents. Richard Broinowski, in his submission to HRSCIR, terms uranium exports 'a pygmy' against 'the enormous export value of Australian coal, iron ore, or non-ferrous metals' (Broinowski, 2005b). Indeed, there is some support for this view from figures produced by the Australian Bureau of Agricultural and Resource Economics (ABARE), which calculates a value of \$427 million for Australian uranium oxide exports in 2002-03. For the same year, comparisons are: \$11897 million for coal exports, \$6402 million for 'crude oil and other refinery feedstock', \$5133 million for gold, \$3660 million for alumina, \$3696 million for aluminium, and \$2607 million for natural gas. Even a lower-order commodity, such as liquid petroleum gas, at \$855 million, registers twice the current export earnings of uranium, and other less notable exports, such as diamonds or lead, at \$660 million and \$649 million respectively, make greater contributions to the Australian economy — and present a lesser threat in terms of environmental consequences (Australian Bureau of Statistics, 2004a, p.508, table 16.22).<sup>6</sup>

Of course, the objection can be raised that current levels of activity are merely the result of restrictions on uranium mining, and that they have little to do with the real capacity of uranium to contribute to Australia's productive capacity. A 1994 study by Access Economics, that argued for unrestricted mining of Australian uranium, forecast a yearly value by 2004 of \$750 million 'in 1994 prices' — still leaving uranium as a less than medium-sized export industry — although it expressed the hope that uranium mining could *become* a medium-sized industry in the future (Access Economics, 1994, p.4). This was a fairly modest claim compared to many now being made. A sobering thought is that it would require dramatic changes to make uranium's contribution to export earnings approach even that of gold. This remains true even if, as some forecasters are predicting, the price of uranium triples again over the next five years (Bromby, 2005). The flaw in this kind of scenario is that it appears to assume that high prices — currently produced by a perception of impending scarcity — would continue even after a rise in export volumes, and this seems contrary to our understanding of the relationship between supply and demand. Certainly, not all commentators see predictions based on current optimism as realistic, even from within the industry (Finch, 2006).

When nuclear opponents move to consider the future prospects of nuclear power plants more closely — in terms of plant construction, operating life and so on — further arguments emerge that can take discussion beyond the realm of claim and counterclaim. After all, the actual number of nuclear power plants in production, and at what level of production, are the true drivers of demand for uranium, and are more certain indicators than the uranium spot price at any particular time, influenced as it is by variations in supply and the vagaries of market sentiment.

From those arguing the negative case, there are some very different interpretations of trends affecting nuclear power plants to what we have seen from proponents. Contrary to projections of

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<sup>6</sup> ABARE *Australian Commodity Statistics*, 2003, quoted in Australian Bureau of Statistics, 2004, p.508, table 16.22.

upward-trending demand for uranium and increases in nuclear power capacity, Friends of the Earth's submission to the HRSCIR argues that the industry is already in decline, having reached an 'historical peak of 294 operating reactors in Western Europe and North America ... in 1989', (Friends of the Earth, 2005, p.4). From this perspective, future scenarios are not looking bright for nuclear power generation. In fact, the average age of nuclear reactors now operating worldwide has already reached the age at which reactors are shut down (21 years) — a rather fundamental intersection of trends that would seem to counter projections of growth (Friends of the Earth, 2005, p.4). Indeed, even nuclear proponents agree that the maintenance of present-day levels of nuclear power generation — and thus the rates of consumption of fuel — are the result of running existing plants at increased capacity, rather than new plants coming into production (Uranium Information Centre, 2005b, p.7).

In making these arguments, Friends of the Earth cite the *World Nuclear Industry Status Report 2004*, which argues that 'the nuclear share of electricity generation worldwide is projected to drop to 12 percent in 2025 from 19 percent in 2001' (Schneider and Froggatt, 2004, p.9).<sup>7</sup> An analysis of trends in 'capacity increase' across all forms of electricity generation shows that, in terms of its percentage stake in an expanding electricity market worldwide, nuclear power's market share is not growing to an extent that would maintain current levels, let alone allow them to expand:

The annual nuclear capacity increase since year 2000 corresponds to about 3,000 MW, including uprating. This figure should be compared to the global increase in all electricity generating capacity of about 130,000 MW to 180,000 MW per year. This leaves nuclear power with a market share of roughly 1.5%-2.5% of the annual increase. Therefore the increased output from nuclear power will not allow nuclear power to even maintain the current 16% share in the world power production and the 6% in the commercial primary energy or about 2% to 3% final energy. All these parameters are already on the decline. (Schneider and Froggatt, 2004, p.6).

The reasons why this is so are not limited to the 'public opposition, waste disposal issues, concerns about nuclear arms proliferation' one might expect (Schneider and Froggatt, 2004, p.9). In the eyes of industry, these factors could perhaps be modified by a combination of communication strategies and 'leadership' from government, although this too is contentious (Uranium Information Centre, 2005b, p.12). The main stumbling blocks are matters of finance and economics — the high levels of capital investment required to finance nuclear power plants; the long lead times before plants come into production, and the volatility of electricity markets. These combine to make 'financing bodies ... very, very hesitant about nuclear power' (Schneider and Froggatt, 2004, p.7).<sup>8</sup> Adding to the scarcity of new nuclear power plants are structural influences in the energy market — among them 'deregulation of power and other market- and policy-based uncertainties' — resulting in a situation where 'no nuclear power company can

<sup>7</sup> 'In its *2003 World Energy Outlook*, the International Energy Agency assumes that nuclear power "will decline progressively", because it will have "trouble competing with other technologies".' Schneider and Froggatt, 2004, p.9.

<sup>8</sup> Quoted from Ken Silverstein, of the consultancy *Energy Industry Analysis*.

afford to take the financial risk of building new nuclear plants' (Schneider and Froggatt, 2004, pp.7-8). This results in significant barriers to creating new plants and bringing them into production:

The industry's legacy of cost growth, technological problems, cumbersome political and regulatory oversight, and the newer risks brought about by competition and terrorism concerns may keep credit risk too high for even [federal legislation that provides loan guarantees] to overcome. (Schneider and Froggatt, 2004, pp.7-8).

If this is true, it would appear that even if government were to 'take the lead', as uranium industry sources hope, to reduce public opposition to an expansion of the nuclear industry in Australia, there are other, more intransigent, factors working against it. If this were to be extrapolated across all potential uranium markets, it would seem that it would be a significant check on moves toward a large-scale sustainable rise in uranium demand.

### Correspondences

News sources that support the affirmative case are by no means scarce. Some of the positive sentiment currently being voiced in the business-oriented news coverage is cited in the introductory paper to this series, in which rising uranium prices and global warming are seen, together, as necessarily ushering in a new age of nuclear power (Wilson, 2006). These sources mirror arguments put forward in the 'affirmative' submissions considered here, painting a picture of increasing numbers of new nuclear power plants being built across the world, dramatically higher uranium prices exacerbated by reduced contributions from 'secondary sources', and prospects of a hydrogen economy based on nuclear power (Bromby, 2005). The present proportion of electricity demand met by nuclear power worldwide (reckoned at one-sixth of present demand) and the example of countries which place a high reliance on nuclear power — such as Lithuania, where it accounts for 80% of electricity production — are, as they are in the submissions, cited as further encouragement for this point of view (Bromby, 2005). All of these elements are brought to bear, together, to reinforce a sense of expectation — and not a little impatience — about the prospect of increasing Australia's nuclear involvement overall.

On the other hand, there are quieter, skeptical voices contributing as well. Minchin, for example, cites a recent report of the International Atomic Energy Agency — hardly an 'anti-nuclear' body — that forecasts a gradual downturn in the proportion of world-wide electricity demand met by nuclear power by 2030, 'even if demand for new plants suddenly jumped' (Minchin, 2005).<sup>9</sup> Other reports raise questions about the economic status of nuclear plants, echoing cases made in the 'negative' submissions considered here. These include newspaper articles on the findings of a recent report for the Victorian government, which casts doubt on the proposition that future nuclear power plants built in Victoria could be economically viable (Doherty and Murphy, 2006).

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<sup>9</sup> Although Trounson, 2005, offers an alternative interpretation of the IAEA report, saying that it assumes a 'business as usual' scenario'.

Even from sources which appear closer to the affirmative than the negative case, such as Trounson (2005), there are — sometimes deep in the body of the article — questions raised over the apparent rallying of the price of uranium, declaring it ‘unpredictable’. However, Trounson is right to indicate that there are a number of variable factors involved, such as the price of oil, and nations’ policy responses to climate change, that determine price outcomes: something that makes it difficult for both nuclear proponents *and* opponents to make clear and confident predictions (2005).

## Discussion

The size and fortunes of the nuclear industry continue to be contentious in the current environment. Those in favour of liberalisation tend to exaggerate the standing of the industry, and may not always be entirely transparent about the ways arguments are made, or the assumptions on which they depend. The current up-swing in the uranium spot price, for example, has been greatly influenced by the tapering of supply from decommissioned nuclear weapons from the former USSR — something the UIC’s submission readily acknowledges (Uranium Information Centre, 2005b, p.7). However, these price effects may not be an indicator of the sustained rise in industry fortunes that the UIC implies: rather it may be that it has an immediate — but short-lived — ‘feel good’ effect on the market.

Opponents of the industry, for their part, have less to say about the possible consequences of *not* meeting current demand for uranium. In adopting a unilateralist position on whether to sell more uranium, there is less evidence of thought as to the real-life effects of what seems to be their preferred option: of ending uranium mining and exports altogether. Given the possibility that the sacrifice could be greater, if any of the projected up-turns in the market fortunes of uranium occur, observers might legitimately challenge positions which propose simply to ‘leave it in the ground’ without exploring the effects, consequences and alternatives arising in connection with this approach.

On the other hand, the negative case makes a palpable hit in casting doubts over claims, made by nuclear proponents, as to the potential scale and economic significance of Australia’s uranium export market. Clearly, uranium mining is not quite of the significance to the Australian economy that its proponents would have us believe — at least not at the moment. In any case, such reckonings are, to a degree, matters of judgement, because they depend not only on hard figures, but also on judgements on costs and benefits. These, in turn, depend on other values invoked by these questions, which must be addressed if this is to be a truly fair and satisfactory debate.

Furthermore, nuclear opponents raise strong points when they consider trends for uranium demand and for the quantum of nuclear power plants likely to be in operation over future decades. Contrary to what might be anticipated, arguments offered on this side of the debate offer a more compelling picture of the economic conditions that would allow — or disallow — a

radical expansion in nuclear power generation. It is a notable gap that arguments for the affirmative fails to address challenges in this respect, particularly those relating to long lead times, financing and other project management aspects of nuclear power plant construction. These appear to detract markedly from nuclear power plant's flexibility of deployment and, in the eyes of some commentators, raise stark questions over whether the numbers of nuclear power plants could ever be raised in sufficient time to meet growing demand, more specifically — to replace power currently generated from burning coal.

## Conclusion

Reviewing this part of the debate, there appear to be logical inconsistencies on both sides: if there is an up-swing in nuclear power generation as nuclear proponents suggest why is there a need to argue for liberalisation? If their argument holds, there is little deliberate action that needs to be taken, unless we take proponents' 'market share' arguments at face value. Conversely, if nuclear opponents' picture of decreasing nuclear capacity holds true, why need they argue against expansion? Clearly in both cases they are, to a degree, rhetorical positions. What this signifies is an important underlying condition for the debate as a whole. The very fact that these arguments *are* being marshalled now shows that this is an historical moment, in which a real opportunity exists to win the support of political constituencies and so set future policy directions.

Clearly, there are interests at stake. If opinion were to go against them, companies who hold interests in uranium would run the risk of being unable to realise on their investments. A scenario, however unlikely, where uranium 'stays in the ground' would have obvious impacts on the worth of mining leases and exploration rights. Even delays would have a negative impact on balance sheets. These are imperatives entirely consistent with the arguments put forward by nuclear proponents. And, indeed, there is nothing inherently wrong with companies seeking a return on investments: without that Australia would be a considerably less prosperous nation. But nor need we become confused as to the relationship between these interests and the wider, collective, interests in the outcome and implications of this decision-making process. Industry interests are only one part of an equation that, in this case, is likely to have considerable consequences, in and beyond Australia, for a very considerable period of time, and striking a balance is imperative.

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