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Nuclear research: Neglect we can't afford

Two important facts provide compelling arguments why Australia should be at the forefront of nuclear spent fuel and waste storage research:

- Australia is a major exporter of Uranium; and
- nuclear power is the world's largest and most promising source of low carbon energy for many countries.

Yet, there are no major research programs into these topics in Australia. Even if we decide never to use nuclear power in Australia, the government's positions on nuclear power and waste storage are inconsistent.

Until 1970 Australia was on track to be a nuclear power user having been involved in nuclear research from the very beginning, including major participation in US and British weapon development. By 1970 two nuclear power stations were planned in Australia, namely Jervis Bay and French Island. Research into long term stabilisation of waste was then initiated by the late Professor Ted Ringwood of the ANU using a material called Synrock and this continued until recent years.

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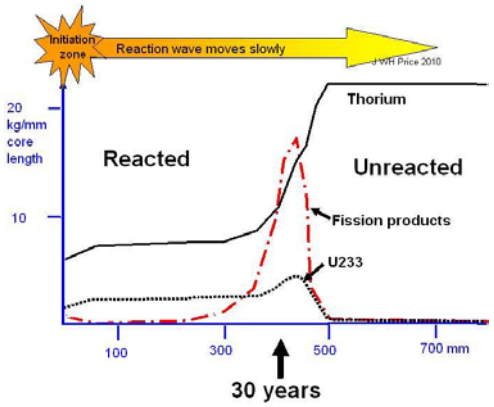
All that has changed. During the 1970s and 1980s nuclear power was banned by the States and a political impasse developed about nuclear waste. Yet, Australia cannot afford to lie low in its research efforts in this area, particularly as global nuclear technology development is everything but standing still.

Judging by Labor Party branch meetings which I have attended and recent public debates, proliferation is the most important issue for the objectors to nuclear power, while arguments about the storage of waste centre on the technical questions of long term stability and security of storage systems.

There are a number of potential research areas through which the nuclear power fuel cycle can be made more proliferation resistant and long term storage can be further investigated. Let me outline a few:

In the case of proliferation, the key issue is how to reduce the number of fissionable nuclides left after the nuclear power is generated. Some nuclear cycle concepts involve low residual fissionable materials.



Thermal wave reactor reaction zone moves slowly through a large cylindrical fuel canister.
The figure is based on material from patent documents. Canister diameter appears to be about 1.5 m and power production is about 150 MW per reaction front.

Examples of these concepts include Thorium based reactors. Originally research into this type of reactor was driven by a perceived shortage of Uranium, and this still may be a motivation in some countries (Australia has plenty of both Uranium and Thorium). A prototype liquid salt Thorium reactor was first tested in the USA in the 1960s. Thorium reactors also appear to have been explored elsewhere, in some cases using circulating solid systems. The advantage of these types of reactors is that fuel is continuously processed and recycled near the reactor so that there are only low levels of fissionable Uranium nuclides at any one time.

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A thermal wave reactor (TWR) has recently been patented, and is currently being marketed under the name Terra Power. The invention received global media attention because of the well publicised backing by Microsoft founder Bill Gates.

This reactor involves long exposure of the fissionable material in the reaction zone so that most fissionable nuclides are consumed (see figure). The idea is that once the reaction wave has passed though the fuel there are only low levels of fissionable materials and decaying fission products remaining. There is no refuelling of the reactor during its life. However, it seems the concept is yet to be demonstrated.

There are also recycling systems which reuse spent fuel in conventional reactors. One such cycle is currently being explored in China where fuels resulting from enriched uranium light water reactors are recycled in China's CANDU reactors. These are heavy water reactors which can use unenriched fuels and thus also apparently partially spent fuels.

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Another important research area is safe handling and storage of spent fuel. There are good reasons why Australia should accept nuclear waste and store spent fuel prior to recycling. One reason is that Australia has a huge area suitable for long term relatively dry and geologically stable storage sites which are remote from significant human habitation. Another reason is that Australia is more politically stable than other potential countries which will inevitably attempt to enter the large scale business opportunities of storage and handling systems.

Australia is also producing radioactive waste, notably by the Australian Nuclear Science and Technology Organisation (ANSTO), which operates a reactor called OPAL south of Sydney. Although ANSTO states on its website it is not involved in nuclear power or in the nuclear fuel cycle, the reactor produces nuclear isotopes for medicine and industry and provides neutron beams for materials research. There is obviously some need for waste storage research due to an unsettled question about where existing commitments are to be stored. This may explain a recent grant of $1.2 million over four years to Curtin University to conduct research into the storage of nuclear waste.

At the time of the Howard Government, collaboration was announced with the Generation IV International Forum for the next generation of nuclear power. This initiative included a grant of $12.5 million over the five years from 2007-08 to 2011-12. Yet, Australia is nowadays not even listed as a member of this forum. ANSTO's web site says that "ANSTO participates" with no further details given. And regrettably, the postgraduate scholarships which were promised by ANSTO for 2009 do not seem to have materialised.

This is a lack of commitment in a major technology area that Australia can ill afford. Our scientists, universities and public are becoming increasingly ignorant of one of the most important low carbon energy contributions which Australia is making to the world.