



Short communication

Shunning nuclear power but not its waste: Assessing the risks of Australia becoming the world's nuclear wasteland

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ARTICLE INFO

Article history:

Received 7 June 2016

Accepted 8 June 2016

Keywords:

Nuclear wastes

Nuclear power

Australia

Risk

ABSTRACT

The South Australian Nuclear Fuel Cycle Royal Commission has undertaken 'an independent and comprehensive investigation into the potential for increasing South Australia's participation in the nuclear fuel cycle'. In its Final Report, issued 6 May 2016, it acknowledges that nuclear power would not be commercially viable in South Australia in the foreseeable future. However it recommends that 'the South Australian Government establish used nuclear fuel and intermediate level waste storage and disposal facilities in South Australia'. This is a business proposition to store a large fraction of global nuclear wastes, providing interim above-ground storage followed by permanent underground storage in South Australia. The present critical evaluation of the scheme finds that the Royal Commission's economic analysis is based on many unsubstantiated assumptions. Furthermore, the scheme is financially risky for both Australian taxpayers and customers and has a questionable ethical basis.

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1. Introduction

Australia does not have nuclear power and the population is divided on whether it should be introduced, with a small majority opposing such a development [1]. However, Australia has the largest uranium resources in the world [2] and was the third largest producer of uranium in 2012 (after Kazakhstan and Canada) [3]. Most uranium is produced from the Olympic Dam copper-uranium-gold-silver mine in South Australia [4]. Neither of the two major political parties, the Liberal-National Coalition or Labor, supports nuclear power officially, although both support uranium mining and export. The Coalition, which is the government in June 2016, has a number of nuclear power advocates in Parliament, while Labor has just a few. The party with the third largest federal Parliamentary representation, the Australian Greens, opposes both nuclear power and uranium mining.

However, despite the political divisions, a business proposition has recently emerged in Australia to store a large fraction of global nuclear wastes, providing interim above-ground storage followed by permanent underground storage in South Australia. This short communication examines critically Royal Commission's economic analysis, the financial risks of the scheme and its ethical basis.

2. Brief summary of Australian energy and nuclear policy

To those unfamiliar with Australia, the country's mainland electricity supply is based predominantly on coal (Fig. 1), although there are large variations between the six states according to their energy resources. The eastern mainland states – New South Wales, Victoria and Queensland – are powered overwhelmingly by coal. Western Australia has a mix of gas and coal. The island state of Tasmania is mostly powered by hydro, supplemented by wind and intermittent imports of brown coal electricity from Victoria. The mainland state of South Australia is powered by wind, natural gas, imports of brown coal electricity from Victoria and rooftop solar in that order of importance, demonstrating a pathway towards a 100% renewable energy future for the whole country [5,6].

In March 2015, concerned about the need for further economic development of the state, which is losing its motor vehicle manufacturing industry, the South Australian Government established the Nuclear Fuel Cycle Royal Commission (NFCRC) to undertake an independent and comprehensive investigation into the potential for increasing South Australia's participation in the nuclear fuel cycle, specifically in four areas of activity:

- expanded exploration, extraction and milling of minerals containing radioactive materials
- the further processing of minerals and the processing and manufacture of materials containing radioactive and nuclear substances
- the use of nuclear fuels for electricity generation

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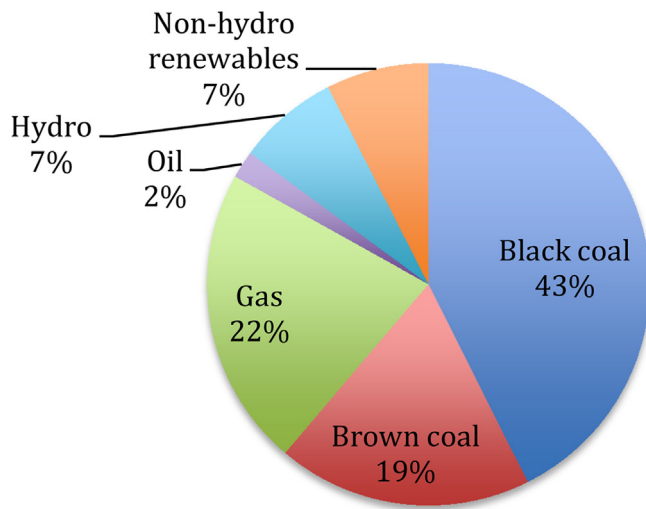


Fig. 1. Australian electricity generation by fuel type, 2013–14, per cent.
Note: 'Non-hydro renewables' comprise wind, biomass and solar.
Source: [7]

- the establishment of facilities for the storage and disposal of radioactive and nuclear waste. [8]

The NFCRC saw its role 'to provide considered advice to government to inform decision-making, not to conduct a poll on whether such activities should occur'. It collected information from written submissions, evidence given by witnesses at public hearings, and commissioned consultancies. The South Australian government appointed a Commissioner who, in a public lecture at Flinders University in November 2014, had acknowledged being "not just an advocate for nuclear industry" [9]. Four months later, after his appointment as the Royal Commissioner, he said essentially the opposite: "I have not been an advocate and never have been an advocate of the nuclear industry" [10]. To assist the Commissioner in evaluating the information, the Commission had staff, a Socio-Economic Modelling Advisory Committee, a Radiation Medical Advisory Committee and an Expert Advisory Committee. Of the five members of the latter committee, two are involved in the nuclear industry, one is an academic who is *inter alia* a pronuclear campaigner, one is a retired academic who is *inter alia* an anti-nuclear campaigner and one is a biological scientist with no apparent connection with, or public stance on, the industry [11]. On this basis, environmental groups have described the process as biased [12].

In May 2016 the Commission released its Final Report [13]. In brief, its principal findings and recommendations were:

- The Commission found that it would not be commercially viable to develop a nuclear power plant in South Australia beyond 2030 under current market rules (pp.55–57). However, it was in favour of keeping the nuclear option open and so recommended (p.xv) [14] that the South Australian Government pursue at the federal level the removal of existing prohibitions on nuclear power generation.
- It recommended that the South Australian Government establish used nuclear fuel and intermediate level waste storage and disposal facilities in South Australia as a business proposition. The intention would be to manage for profit a large percentage of global nuclear waste by means of both interim above-ground storage and permanent underground storage.

The present article examines the feasibility of the second of these two findings/recommendations.

3. Could South Australia store global nuclear wastes?

The Commission tried to justify its proposal on the following grounds:

1. The geology of South Australia is old and stable, and the climate is arid with occasional floods.
2. 'Two countries, Finland and Sweden, have successfully developed long-term domestic [geological] solutions.' (NFCRC pp.83–85)
3. Nuclear power is presently, and will remain in the foreseeable future, a low-carbon energy technology.
4. Globally there are large quantities of spent fuel from nuclear reactors in temporary storage, so a potential market exists (pp.92–93).
5. Economic analysis (based on several assumptions) appears to show that huge profits could be made by South Australia.
6. Commercial risk is negligible, because 'the state... need not incur substantial expenses until it is certain that these will be covered by future revenues' (p.104).
7. Although the management, storage and disposal of international nuclear waste require social consent, this could be gained by 'careful, considered and detailed technical work' (p.73).
8. Australia, as a uranium exporter, has an ethical responsibility to accept nuclear wastes from countries that buy its uranium.

These points are examined critically below.

3.1. Geology

While the underlying geology of South Australia is indeed, to quote the Commission (p.89), 'old and stable' with 'very low [seismic] activity on a global scale', it experienced an earthquake of magnitude 6.5 in 1897 and about 40 earthquakes with magnitudes over 4.5 since 1872 (p.89–90). Although the climate is indeed arid (p.89), large parts of the state experience occasional heavy floods (p.90), a fact that would restrict siting of both the above-ground temporary repository and the underground permanent repository.

3.2. Experience with long-term underground repositories

The Commission's headline claims that 'Finland and Sweden, have successfully developed long-term domestic [geological] solutions' is premature. Even the text of the section under this heading acknowledges that the two countries only have 'underground research laboratories' and that 'operations [to store waste] are expected to start in the early 2020s' (p.85).

The military Waste Isolation Pilot Plant (WIPP) in New Mexico, USA, is the only deep geological repository for nuclear waste in the world. The Commission's report mentions that WIPP has received intermediate-level nuclear waste from the US military program, but dismisses the relevance of an accident that has suspended its operation for the past two years. A chemical explosion in a nuclear waste barrel on 14 February 2014, followed by failure of the filtration system, exposed 21 workers to small internal radiation doses from plutonium and americium and released 'trace amounts' of these elements that were detected off-site [15]. While the US Environmental Protection Agency found that there was no *public* health hazard [16], the internal exposure of the workers should be of concern, because the inhalation or ingestion of even a few millionth of a gram of the above alpha-emitters may increase the risk of developing cancer of the lungs, liver or bones. For radiation workers in the USA, the maximum permissible life-time body burden for plutonium is 0.65 millionth of a gram [17].

To sum up, contrary to the impression created by the Commission's report, there is no operating experience anywhere in

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