



Nuclear Energy and Waste in Australia

An Interlaw Publication

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1. Introduction

Australian law currently prohibits nuclear power generation. The only use of nuclear technology in Australia is for medical and research purposes. Australia's only nuclear facility operated by the Australian Nuclear Science and Technology Organisation (**ANSTO**), is located at Lucas Heights in Sydney, New South Wales.

As a result of the medical and research nuclear processes, Australia generates low and medium level radioactive waste. Australia has implemented law and policy to manage this waste. Whilst Australia has adopted best practices under international obligations, debate continues around proposals for a centralised nuclear waste storage facility for the country.

Going forward, recent developments in the State and Federal arena suggest Australia is investigating further the possibility of the implementation of nuclear power generation, and it being a way to assist Australia in meeting greenhouse gas emission targets. However, this is not likely to occur in the near future.

This chapter considers the context of Australia's energy production and use; Australia's international obligations pursuant to conventions entered; the federal nuclear energy and waste legislation framework; recent developments specifically in relation to nuclear waste law; and recent reports which consider the future of nuclear energy in Australia.

2. Australia's Energy Context¹

2.1 Australia's Current Energy Mix

Australia is currently heavily reliant on fossil fuels. Oil, coal and gas produced 94 per cent of Australia's energy in the 2013-2014 period. The remaining 6 per cent was produced using renewable resources. Nonetheless, renewable energy consumption grew by 4 per cent over the period year and has seen an average annual growth of 2.4 per cent over the last 10 years. Conversely, consumption of both coal and oil for energy has recently been trending downwards.

In the same 2013-14 period, Australia's two largest energy consuming industries were transport and electricity supply. Each accounted for approximately 27 per cent of the total Australian energy consumption for the 2013-14 period. Mining accounted for 9.1 per cent of total energy consumption.

2.2 Australia's Electricity Generation mix

Increased energy efficiency, reduced industrial demand, and consumer in response to both reducing carbon emissions and high retail prices, led to an overall decline in electricity generation in Australia for the 2013-14 period. Despite this, renewable generated electricity rose by 11.6 per cent, growing to 15 per cent of total electricity generation. Although fossil fuels accounted for 85 per cent of the electricity generated, average annual growth was negative 2.5 per cent.²

2.3 International Comparisons

Australia is a country with large energy producing capabilities, and comparatively low energy consumption. In 2013 Australia was the 8th largest producer of energy in the world, however was only the 20th largest consumer of energy. In relation to electricity generation, Australia was the

¹ Department of Industry and Science (2015), *2015 Australian Energy Update*, Canberra, August 2015.

² *Ibid.*

19th largest producer, but ranked 25th in relation to electricity output from renewable energy sources.³

2.4 Nuclear Power in the Mix

Contextually, Australia is currently one of the highest carbon dioxide emitting countries in the world on a per capita basis.⁴ Australia currently does not produce nuclear energy however, it ranks higher than all countries with operational nuclear power plants with the exception of the United States.⁵ Following the Paris Agreement at the United Nations Climate Change Conference (2015) to limited the global average temperature to well below 2 degrees Celsius, it has been suggested that nuclear power will assist a transformation within the energy sector – it could reduce emissions and support pathways to decarbonise other economic sectors.⁶ Australia has committed to a 26-28 per cent reduction on 2005 levels by 2030 which represents a 50-52 per cent reduction in emissions per capita.⁷ It is noted that nuclear power is unlikely to contribute to reductions before 2030 due to the time required for new capacity to be operational. It could however assist rapid action to reach a net zero emissions target from energy generation by 2050.⁸

However, some commentators have linked the viability of nuclear power generation in Australia explicitly to mechanisms of pricing the cost of greenhouse gas emissions.⁹ Currently Australia does not have a price on carbon or an emissions trading scheme. This means the cost of electricity generation by fossil fuels, including coal which is an abundant resource in Australia, is very cheap.

2.5 Uranium Mining in Australia

Uranium is also an abundant resource in Australia. Australia has the largest reserves of uranium in the world, with approximately 34 per cent of total reserves.¹⁰ However, it is currently the third biggest producer of uranium, accounting for 9 per cent of world production.¹¹ Australia has three operational uranium mines including Ranger, Northern Territory; Olympic Dam, South Australia; and Beverley-Four Mile, South Australia. In 2013, the Honeymoon mine in South Australia closed. The production of those mines over the past decade is outlined in the following Table:

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Ranger	5256	5273	5678	4262	2677	3284	4313	1113	2044

³ Department of Industry, Innovation and Science (2016), *Energy in Australia 2015*, Canberra.

⁴ The World Bank, *2011 CO2 emissions (metric tons per capita)*, Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States accessed at data.worldbank.org

⁵ Ibid.

⁶ Nuclear Fuel Cycle Royal Commission, Government of South Australia, Nuclear Fuel Cycle Royal Commission Report, 2016, 2.

⁷ Department of the Environment and Energy, 'Australia's 2030 climate change target' access 28 July 2016 at <https://www.environment.gov.au/climate-change/publications/factsheet-australias-2030-climate-change-target>

⁸ Ibid, 4.

⁹ Durrant N, 'Legal Responses to Climate Change' (2010).

¹⁰ Geoscience Australia, 'Uranium Mining' accessed 28 July 2016 at <http://www.ga.gov.au/scientific-topics/minerals/mineral-resources/uranium#heading-1>.

¹¹ World Nuclear Association, 'Uranium Mining in Australia' accessed 28 July 2016 at <http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/appendices/australia-s-uranium-mines.aspx>

Olympic Dam	3474	4115	3974	2258	4012	3853	4064	3988	3144
Beverley	847	707	626	630	347	413	453	188	0
Four Mile							0	186	922
Honeymoon	0	0	0	0	0	151	124	37	0
Total	9577	10095	10278	7150	7036	7701	8954	5512	6110

Table 1. Production from Australian Uranium Mines (tonnes of Uranium – U₃O₈)¹²

Uranium mining is currently permitted in South Australia, the Northern Territory, Western Australia and Queensland. New South Wales allows for exploration permits only¹³, whilst Victoria prohibits both exploration and mining.¹⁴ In Tasmania there is no express restriction in relation to uranium mining or exploration except for the requirement to obtain a licence.¹⁵ Large tracts of Tasmania are listed as World Heritage Areas of National Parks. There are no known uranium deposits in the Australian Capital Territory.

3. Australia's International Obligations

3.1 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Australia signed the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)* on 13 November 1998, with the Joint Convention being entered into force on 3 November 2003.¹⁶

Australia's obligations under the Joint Convention are met through the *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth) (see below).

3.2 International Convention on Nuclear Safety (1996)

Since the *International Convention on Nuclear Safety* was ratified by Australia in December 1996, Australia has submitted five National reports to Convention Review Meetings under the Convention, the last being in August 2013.¹⁷

However, as current Australian laws such as the *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) prohibit the construction and operation of nuclear installation, only research reactors, such as ANSTO (Australian Nuclear Science and Technology Organisation) in Sydney, New South Wales, are discussed in the reports.¹⁸

¹² Ibid.

¹³ *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* (NSW).

¹⁴ *Nuclear Activities (Prohibitions) Act 1983* (Vic).

¹⁵ *Mineral Resources Development Act 1995* (Tas).

¹⁶ Treaties tabled on 12 November and 3 December 2002, Report 51

¹⁷ Australian Radiation Protection and Nuclear Safety Agency, Convention on Nuclear Safety, <http://www.arpansa.gov.au/aboutus/collaboration/nucsafety.cfm>

¹⁸ Commonwealth of Australia, Convention on Nuclear Safety: Australian National Report, August 2013 pg. 4 http://www.arpansa.gov.au/pubs/nsb_trpt/ausrep10.pdf

3.3 Convention of the Physical Protection of Nuclear Material (CPPNM) and the International Convention for the Suppression of Acts of Nuclear Terrorism

Recently, Australia has ratified the 2005 Amendment to the Convention of the Physical Protection of Nuclear Material (CPPNM) and the International Convention for the Suppression of Acts of Nuclear Terrorism.¹⁹ Overall Australia's international obligations in relation to these agreements are given effect locally through the *Nuclear Non-Proliferation (Safeguards) Act 1987* (Cth) (see below).

4. Current Nuclear Energy and Waste Statutory Framework

Currently, the construction or operation of nuclear energy plants in Australia cannot be approved under the *Environment Protection and Biodiversity Act 1999* (Cth) or the *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth). The *Nuclear Non-Proliferation (Safeguards) Act 1987* (Cth) gives effect to international non-proliferation obligations. The *National Radioactive Waste Management Act 2012* (Cth), (see below), was developed in accordance with the Joint Convention.

4.1 Nuclear Non-Proliferation (Safeguards) Act 1987 (Cth)

As stated previously, Australia's international obligations are given effect locally through the *Nuclear Non-Proliferation (Safeguards) Act 1987* (Cth) (**Safeguards Act**).

These obligations are met through the mechanisms in the Act which established the Australian Safeguards and Non-Proliferation Office, known as ASNO. ASNO is an independent regulator. The Director General of ASNO, currently Dr Robert Floyd, is responsible directly to the Federal Parliament.²⁰

Australia's international obligations in relation to non-proliferation are also met through the following domestic pieces of legislation:

- *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth);
- *Weapons of Mass Destruction Act 1995* (Cth); and
- *Customs Act 1901* (Cth).

Under the Safeguards Act permits are required for possession and transportation of nuclear material and 'associated items, materials, equipment, and technology' as defined by the Safeguards Act. Permits are also required for the establishment and decommissioning of nuclear facilities.²¹

4.2 Australian Radiation Protection and Nuclear Safety Act 1998

Further permits are required under the *Australian Radiation Protection & Nuclear Safety Act 1998* (Cth) (**ARPANS Act**) for certain activities involving nuclear products.

The ARPANS Act controls the construction of controlled facilities, possession of controlled material and controlled apparatus, and allows for the licensing of controlled facilities, including

¹⁹ National Progress Report: Australia, Nuclear Security Summit, 31 March 2016, <http://www.nss2016.org/document-center-docs/2016/3/31/national-progress-report-australia-1>)

²⁰ ASNO organisational chart, <http://dfat.gov.au/international-relations/security/asno/Pages/asno-organisational-chart.aspx>, accessed 25 July 2016

²¹ *Nuclear Non-Proliferation (Safeguards) Act 1987* (Cth), Sections 16A and 16B.

nuclear reactors for research and medical use, radioactive waste storage facilities, plants for preparation and production of fuel, and prescribed legacy sites.²²

Some facilities and activities will require permits under both the ARPANS Act and the Safeguards Act (as discussed above).²³

A licence cannot be issued under the ARPANS Act for a nuclear fuel fabrication plant, a nuclear power plant, an enrichment plant, or a reprocessing facility.²⁴

The ARPANS Act also established ARPANSA which develops the national codes of practice for protection from the harmful effects of radiation based on international requirements and promotes their application by state and territory regulators.

The ARPANS Act aims to create a regulatory regime for the licensing of the possession of certain radioactive materials, and the construction, operation and decommissioning of nuclear installations, by or on behalf of the Australian Government.

4.3 Environment Protection and Biodiversity Conservation Act 1999

The over-arching environment protection legislation at a federal level in Australia is the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**). Assessment under the Act is triggered where actions are likely to have a significant impact on matters of national significance, including World Heritage sites, sites of National Heritage, Ramsar wetland sites, and nuclear actions (as well as others).²⁵

Approval under the EPBC Act is required for nuclear actions. Nuclear actions include the following.²⁶

- (a) *establishing or significantly modifying a nuclear installation;*
- (b) *transporting spent nuclear fuel or radioactive waste products arising from reprocessing;*
- (c) *establishing or significantly modifying a facility for storing radioactive waste products arising from reprocessing;*
- (d) *mining or milling uranium ore;*
- (e) *establishing or significantly modifying a large scale disposal facility for radioactive waste;*
- (f) *de commissioning or rehabilitating any facility or area in which an activity described in paragraph (a), (b), (c), (d) or (e) has been undertaken;*
- (g) *any other action prescribed by the regulations.*

Further, a nuclear installation includes the following.²⁷

²² *Australian Radiation Protection & Nuclear Safety Act 1998* (Cth). Part 5 Division 1.

²³ *Australian Radiation Protection & Nuclear Safety Act 1998* (Cth), Section 9.

²⁴ *Australian Radiation Protection & Nuclear Safety Act 1998* (Cth), Section 10.

²⁵ *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Part 3.

²⁶ *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Section 22.

²⁷ *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Section 22.

- (a) a nuclear reactor for research or production of nuclear materials for industrial or medical use (including critical and sub critical assemblies);
- (b) a plant for preparing or storing fuel for use in a nuclear reactor as described in paragraph (a);
- (c) a nuclear waste storage or disposal facility with an activity that is greater than the activity level prescribed by regulations made for the purposes of this section;
- (d) a facility for production of radioisotopes with an activity that is greater than the activity level prescribed by regulations made for the purposes of this section.

Note: A nuclear waste storage or disposal facility could include a facility for storing spent nuclear fuel, depending on the regulations.

Offences are created by the EPBC Act for any constitutional corporation, Commonwealth agency, or person, who undertakes a nuclear action and the nuclear action results or will result in a significant impact on the environment.²⁸

Further, no action for the construction or operation of a nuclear fuel fabrication plant, a nuclear power plant, an enrichment plant, or a reprocessing facility can be approved by the Minister under the EPBC Act.²⁹

Due to the overall prohibition of nuclear actions, an amendment would need to be made to the EPBC Act for a nuclear fuel fabrication plant, a nuclear power plant, an enrichment plant, or a reprocessing facility to be established in Australia.

4.4 Australian Nuclear Science and Technology Organisation Act 1987

The *Australian Nuclear Science and Technology Organisation Act 1987* (Cth) established ANSTO. Its functions are set out in Section 5 of the Act and include carrying out research in relation to nuclear science and technology; supervising the activities of persons mining, treating or selling uranium; conditioning, managing and storing radioactive materials; and providing advice to the Government in relation to these matters.

4.5 State Legislation

Some States have separate laws which also prohibit the construction of nuclear power facilities. The following legislation includes a general prohibition of nuclear facilities:

- *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* (NSW) – section 8;
- *Nuclear Facilities Prohibition Act 2007* (Qld) – section 7; and
- *Nuclear Activities (Prohibitions) Act 1983* (Vic) – section 8.

These Acts generally prohibit the construction or operation of nuclear facilities, which includes nuclear reactors, in the respective states. In some circumstances, the construction or operation of a nuclear facility authorised under an act of the Australian Government will not be prohibited (see for example *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* (NSW) – section 8 (3)).

²⁸ *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Section 22A.

²⁹ *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Sections 140A and 146M.

5. Nuclear Waste in Australia

5.1 Introduction

Whilst Australia does not generate energy from nuclear power stations, Australia still has to manage nuclear waste. Australia's nuclear or radioactive waste results from medicine, research and industry activities. These activities produce a relatively small amount waste. For example, the amount of waste produced as of 2010 in Australia was 4,255m³. For the same period Spain produced 43,252m³ and the United States produced 17,252,672m³.

Australia currently does not have the facility for reprocessing spent fuel used in the national research reactor located at ANSTO Sydney, NSW. Instead, Australia exports spent fuel to be processed in France and the United Kingdom, with the residual waste being returned to Australia. Transportation of radioactive material is undertaken in accordance with the Australian *Code of Practice for the Safe Transport of Radioactive Material* (2008).

To date, Australia only has approximately 4,250m³ of low level radioactive waste and approximately 656m³ of intermediate level radioactive waste. The radioactive waste is managed predominantly by the Commonwealth Government, with a small amount being held by the states and territories.

The Australian Commonwealth's inventory of waste is as follows:³⁰

Waste Type	Waste description	Commonwealth waste inventory (approximate volume)
Low Level Waste	Lightly contaminated laboratory items	Total – 4,048.28m ³
	Operational waste from the research reactor	1,936m ³ operational waste (held at ANSTO, Lucas Heights, New South Wales)
	Contaminated items from production of radiopharmaceuticals	2,100m ³ lightly contaminated soil from ore-processing research held by CSIRO at Woomera, South Australia
	Research reactor decommissioning waste such as graphite, concreted and steel.	0.28m ³ waste held at ARPANSA, Yallambie, Victoria
	Lightly contaminated soil	12m ³ held by Department of Defence
Intermediate Level Waste	Higher activity operational waste form ANSTO including irradiation cans, ion exchanges resins aluminium end pieces of fuels rods, controls arms and general waste from radiopharmaceutical production.	Total—551.5 m3
	Concentrates from mineral sands processing (thorium and uranium	451m ³ at ANSTO, including 275m ³ operational waste, 165m ³ of thorium and uranium residues from mineral sands processing and 11m ³ liquid waste from production of Molybdenum-99 for radiopharmaceuticals. These volumes will increase when the waste is conditioned for transport

³⁰ Department of Industry, Innovation and Science National Waste Management Facility 'Australia's Radioactive Waste' accessed 27 July 2016 at <http://www.radioactivewaste.gov.au/radioactive-waste-australia/australias-radioactive-waste>

residues)

4m³ held by the CSIRO.6.5m³ waste held at ARPANSA, Yallambie,
Victoria90m³ held by Department of Defence

Table 2 - Australia's Inventory of Nuclear Waste

The 2015/16 Australian Government budget announced significant funding for ANSTO, enabling expansion of the nuclear medicine production program, and new environment, health and industrial research.³¹ Of the \$193 million allocated to ANSTO, \$49.1 million will go towards its Sydney facility responsible for the production of nuclear medicines, and \$22.3 million will go towards waste storage facilities. This will allow for the waste to be held until the National Radioactive Waste Facility is operational.³²

Although the funding does not seek to commence generation of nuclear energy, it marks strategic steps towards improving Australia's nuclear medicine and technology production, as well as its capability to deal with nuclear waste.

The *National Radioactive Waste Management Act 2012* (Cth) is the central piece of legislation which sets out the current law relating to nuclear waste disposal. Prior to this act the *Commonwealth Radioactive Waste Management Act 2005* (Cth) established a program for the construction of co-located waste management facilities, replacing two abandoned projects being the National Store Project, for intermediate level radioactive waste, and the National Repository Project, for low level radioactive waste.

5.2 National Radioactive Waste Management Act 2012

On 4 April 2012, the *National Radioactive Waste Management Act 2012* (NRWM Act) came into effect. It aimed at providing procedural regulation for establishing a single, centralised National Radioactive Waste Management Facility (**Facility**).

The Australian Government has stated that the NRWM Act promotes the consistent, safe and responsible management of radioactive waste, in accordance with Australia's obligations as a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Explanatory memorandum to the bill of the NRWM Act noted the scientific rationale was to ensure waste was managed in accordance with rigorous national and international standards. Once the Facility is constructed, low level waste will be disposed of by burial and intermediate waste will be stored on site.³³

Part 4 of the NRWM Act provides for acquisition powers in relation to sites selected for a waste Facility. Part 5 notes that certain State, Territory and Commonwealth laws will not apply to activities under the NRWM Act, but that the ARPANS Act, EPBC Act and Safeguards Act must be complied with, as discussed above.

³¹ Macfarlane "Investing in science, research and energy for Australia's competitive future", 12 May 2015.

³² ANSTO "Australia's nuclear agency welcomes 2015/16 budget", published 13 May 2015.

³³ *National Radioactive Waste Management Bill 2010*, Explanatory Memorandum, circulated by the Minister for Resources and Energy.

5.3 National Radioactive Waste Management Project

The National Radioactive Waste Management Project (**The Project**) was established to implement the NRWM Act, the Facility, and Australia's policy is that all waste generated in Australia must be stored or disposed of within Australia.

The Facility will replace more than 100 interim storage sites across Australia currently in hospitals and universities that have been used on an ad hoc basis for the past 50 years.

In 2013, a report prepared by Enresa investigated the design requirements for the Facility. It provided a guide to the siting, design and commission of the Facility. It also outlined technical procedures in relation to waste packaging and acceptance, safety, and radiological protection.³⁴

The Project involves four steps which will lead to the construction and operation of the Facility in 2017-2020. The timeline for those steps is as follows:³⁵

Phase	Indicative Timeline	Description
1 Nominations, Site assessment and Shortlist	2015-2016 CONCLUDED	Seek voluntary nominations, provide communities project information, seek willingness to continue in the process.
2 Site Characterisation Studies and Preferred Site Identification	2016-2017	<p>Establish Regional Consultative Committee with broad based local participation.</p> <p>Establish locally engaged officer.</p> <p>The community will provide input into design including infrastructure requirements, risk and safety cases, local business and employment opportunities and community benefits measures.</p> <p>The Committee will also assist in developing proposals to address short term disruption including through education and communication strategies.</p> <p>The Government will then seek broad community support for hosting facility.</p>
3 Site Selection, Facility Design and Licensing	2017-2018	<p>Development of Government's Detailed Business Case with final engineering and other technical design and costings.</p> <p>The Government submit proposals for environmental and radiation regulatory</p>

³⁴ Enresa, 'Conceptual Design for a Near Surface Low Level Waste Disposal Facility and Collocated aboveground Long Lived Intermediate Level Waste Storage Facility in Australia', 3 December 2016 accessed at <http://www.radioactivewaste.gov.au/sites/> .

³⁵ Department of Industry, Innovation and Science, 'National Radioactive Waste Management Facility – Project Phases' accessed 27 July 2016 at www.radioactivewaste.gov.au/project-phases.

		approvals.
		Establishment of a Facility Management Committee with community representation.
		On-going community engagement on benefits measures and capacity building for businesses and employees.
4	2018-2020	Construction undertaken consistent with community requirements.
Construction		Local business and employment goals to be achieved.
Operation	2020+	Facility Management Committee with community representation to oversee facility.
	Operation for 100 years and monitoring for 200-300 years	Monitoring of facility published and provided publicly.
		Facility and employees to be active members of community.

Table 3 - National Radioactive Waste Management Project timeline

Phase 1 outcomes

Phase 1 was conducted in 2015-2016. Consultation was undertaken with communities and stakeholders of the 28 sites that were voluntarily nominated. Six possible sites were shortlisted for further public comment. Phase 1 was finalised following the closure of this consultation period on 11 March 2016.

On 29 April 2016, the Australian Government announced the land nomination at Barndioota, South Australia would proceed into Phase 2. It was identified as having the most sufficient broad community support of the six shortlisted sites.³⁶

Phase 2

The Barndioota site will move into phase 2, however the Australian Government has allowed for further nominations of new sites to be made.³⁷

5.4 Final Site Selection

Final site selection is to be subject to approval under the EPBC Act and the ARPANS Act. The Government has stated the design and operation of the facility must adhere to best practice established under the International Atomic Energy Agency.³⁸

³⁶ The Hon Josh Frydenberg MP, Minister for Resources, Energy and Northern Australia, 'Media Release: Site shortlisted for National Radioactive Waste Management Facility', dated 29 April 2016.

³⁷ Ibid.

³⁸ Department of Industry, Innovation and Science, 'Phase 2, Shortlisted Sites for Phase 2', accessed at <http://www.radioactivewaste.gov.au/project-phases/phase-2> on 26 July 2016.

5.5 Independent Advisory Panel

The Independent Advisory Panel to the National radioactive Waste Management Facility (**IAP**) was established to provide an understanding of technical and community issues associated with implementation of The Project. It assisted in the nomination process.

The IAP will provide advice to the relevant Government Departments regarding the implementation of The Project in accordance with international best practices, international legal obligations, the NRWM Act, and Australia's other radiation and environmental protection regulatory regimes.

6. Current Debate in Australia

6.1 Future of Nuclear Energy

The Commonwealth Scientific and Industrial Research Organisation (**CSIRO**), Australia's leading scientific body, has recognised some of the benefits that would follow the introduction of nuclear energy to Australia's energy mix.³⁹ As Australia seeks to fulfil its carbon emission reduction commitments, it will need an energy source that can replace the base load electricity generation currently provided by coal fired power plants. The CSIRO sees nuclear energy as potentially filling this role, particularly with future improvements in relation to safety and lower waste production. It notes the major obstacle, as with most countries, is how to deal with the waste and the consequential social resistance on environmental safety grounds.

The CSIRO notes from a theoretical perspective, the key questions if Australia was to add nuclear power would relate to:

- *Legislative and regulatory framework development, including for protection, operational safety, waste storage and decommissioning*
- *Education and science and technical skills development*
- *Commercial and economic frameworks to support significant up-front capital costs and eventual plant decommissioning*
- *A 10-15 year interval for start-up of a first reactor*
- *Reactor locations*
- *Water use, and*
- *Political and social acceptance of nuclear power.*

In 2015, Prime Minister Malcolm Turnbull appointed Dr Alan Finkel as Australia's Chief Scientist. Following this, Dr Finkel indicated that Australia's energy future would involve a shift from coal, oil and natural gas to alternative energy sources including nuclear power.⁴⁰ Dr Finkel has

³⁹ CSIRO National Research Flagships (2011), *Unlocking Australia's Energy Potential*, accessed 27 July 2016 at http://industry.gov.au/Energy/Documents/Unlocking_Australias_Energy_Potential.pdf

⁴⁰ Sydney Morning Herald, "Chief Scientist Alan Finkel calls for dialogue on alternative energy, including nuclear." 28 October 2015.

indicated that in Australia, nuclear energy would play a role in lowering Australia's emissions. Dr Finkel has historically strongly advocated for the introduction of nuclear power.⁴¹

6.2 Energy White Paper

The Energy White Paper 2015 was released by the Government in April 2015 and it outlined a policy framework for the future of Australia's energy industry and rationale for actions to address current challenges. Nuclear energy is referred to in the report in relation to future energy resource investment and Australia's future energy mix.⁴²

The White Paper notes the Australian Government will watch and consider the outcomes of the South Australian Royal Commission into its future involvement in the nuclear fuel cycle (referred to below). The Australian Government will also monitor international developments on nuclear technology and energy.

The White Paper notes ongoing investment in the nuclear regulatory framework and further development of Australia's nuclear knowledge and skills will underpin future regulatory capability, if required. To increase potential investment, the Australian Government will consider improvements including responding to technical developments and the streamlining.

The White Paper further indicates a possible future change of approach to nuclear energy and regulation by the Australian Government.

6.3 South Australian Royal Commission

The potential introduction of nuclear energy into Australia's mix is arguably the closest it has been in decades. The recent South Australian Government official inquiry, more than any other recent development, highlights this.

On 19 March 2015, the Premier of South Australia and Executive Council, released its terms of reference for the nuclear inquiry. The terms of reference established the Nuclear Fuel Cycle Royal Commission to inquire into and report upon matters being:

1. Exploration, Extraction and Milling – including the feasibility of expanding the milling of minerals containing radioactive materials;
2. Further Processing and Manufacture – including the conversion, enrichment, fabrication or re-processing of radioactive and nuclear substances;
3. Electricity generation – including the feasibility of establishing facilities to generate electricity from nuclear fuels with reference to advantages/disadvantages this source opposed to other sources, and the measures that might be required to facilitate and regulate their establishment and operation; and
4. Management, Storage and Disposal of Waste – including the feasibility of storage facilities and the measure that might be required to facilitate and regulate them.

The Honourable Kevin Scarce AC, was appointed as the Commissioner of the inquiry.

⁴¹ See Finkel, "We need abundant reliable power. Why not nuclear" Herald Sun, 28 October 2013; Finkel. "Switch on to the electric planet" AFR, 20 October 2013; Finkel "Putting nuclear in the debate" ATSE Focus Magazine, Number 179, August 2013.

⁴² Department of Industry and Science (2015) 'Energy White Paper 2015', accessed 27 July 2016 at <http://ewp.industry.gov.au/sites/prod.ewp/files/EnergyWhitePaper.pdf>

The Royal Commission published issue papers in relation to each of the four identified inquiry points, which were open to public comment for three months. The Commission's investigation involved over 37 sitting days of expert evidence from international witnesses and numerous formal reports.

Tentative findings were published on 15 February 2016, and the Commission sought further public responses. The Commissioner considered all responses and has prepared the final report which was released on 8 May 2016, being the *Nuclear Fuel Cycle Royal Commission Report 2016 (Report)*.

6.4 Royal Commission Report Findings

The Report concluded that South Australia could safely increase its participation in nuclear activities. That participation was found to come with social, environmental, safety and financial risks, which the State was already managing or could manage. The management, storage and disposal of waste, was a particular phase of the nuclear fuel cycle that the report concluded could provide enduring economic benefits to the community.⁴³

In relation to electricity generation from nuclear fuels, the Commission made the following findings:⁴⁴

- It is not currently commercially viable to develop a nuclear power plant in South Australia.
- However, it may nonetheless be required due to the need to significantly reduce carbon emissions.
- Action should be taken now for its potential implementation, including amending the EPBC Act prohibitions on nuclear power generation to allow it to contribute to a low-carbon electricity system, if required.
- The South Australian Government should promote and collaborate on the development of a comprehensive national energy policy that includes nuclear technologies.
- The South Australian Government should collaborate in relation to potential reactor designs that may offer economic value for nuclear generation.

In relation to management, storage and disposal of radioactive waste, the following findings were made:

- Deep geological disposal is the best available approach to long-term disposal of used nuclear fuel;
- Safety of disposal can be assured through geological and engineered barriers and the prediction of geological conditions.
- A waste disposal facility could generate \$51 billion during its operation and create a fund of \$445 billion over 70 years;

The following recommendations were made by the Royal Commission:

⁴³ Nuclear Fuel Cycle Royal Commission, Government of South Australia, *Nuclear Fuel Cycle Royal Commission Report*, 2016.

⁴⁴ *Ibid*, xiv.

- The South Australian Government pursue the opportunity to establish used nuclear and intermediate level waste storage and disposal facilities, and that further investigations and steps be taken to do this;
- The South Australian Government remove the legislative constraint in section 13 of the *Nuclear Waste Storage Facility (Prohibition) Act 2000* that would preclude an orderly, detailed and thorough analysis and discussion of the opportunity to establish waste facilities in South Australia.
- The South Australian Government investigate whether and on what basis potential client nations would be willing to commit to participate.

6.5 Renewed Proposal for International Repository

The South Australian Royal Commission has renewed the debate about whether Australia should host an international repository for nuclear waste. There have been multiple proposals in the recent past in which it has been suggested that Australia could appropriately accept international nuclear waste.

In 1984, a report prepared by the Australian Science and Technology Council recommended Australia proceed with uranium mining and become involved at other stages of the fuel cycle. This included international collaboration in developing waste management programs in high quality geological sites.

In the 1990's, a program by Pangea Resources investigated various sites with good geological credentials for an international repository. Australia was favoured due to the geological and political stability. A formal report was released to the Australian public in 1999, however the Australian Government stood by its policy of not importing nuclear waste.⁴⁵

In the 2016 Report, the South Australian Royal Commission recognised that the activity of storing locally produced low and intermediate level waste presents different risks and opportunities than storing international waste for power generation. Nonetheless, it recognised significant opportunities to be investigated. The Royal Commission recognised the following in relation to the establishment of an international repository:⁴⁶

- There is international consensus that geological storage is the preferred method of nuclear fuel disposal, and that geological conditions need to be thoroughly analysed and understood.
- South Australia has a unique combination of attributes that offer a safe, long term capability for the disposal of used fuel.
- The storage and disposal of internationally used fuel and intermediate level waste in a South Australian location is likely to be technically feasible.
- International conventions, such as the Joint Convention, require countries to address waste management domestically, however international solutions for disposals are permitted and would likely require the entering of bilateral agreements.

⁴⁵ World Nuclear Association, 'International Nuclear Waste Disposal Concepts' accessed 28 July 2016 at <http://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/international-nuclear-waste-disposal-concepts.aspx>

⁴⁶ Nuclear Fuel Cycle Royal Commission, Government of South Australia, *Nuclear Fuel Cycle Royal Commission Report*, 2016, Chapter 5.

- Used fuel management is an issue of global concern. The report goes so far as to state:

As Australia is a net exporter of energy, it has a significant role to play in assisting other countries to lower their carbon emissions. This includes countries with less opportunity for large scale renewable energy deployment than Australia, for whom nuclear power makes a substantial contribution to their production of low carbon energy. For new nuclear entrants or countries with little prospect of siting their own used fuel disposal facilities, an international solution would remove a significant impediment to the new or ongoing use of nuclear power as a low carbon technology. As a result Australia would derive a reputational and financial benefit by hosting a facility for the disposal of international used fuel.⁴⁷

- Given the quantity of used fuel held by countries without a solution for its disposal, it is reasonable to conclude a South Australian disposal facility would be financially viable.

The Report however, provides relatively little discussion about environmental, cultural and intergenerational implications of the establishment of a facility to take high level radioactive waste.

6.6 Indigenous Culture and Nuclear Activities

The connection of Aboriginal communities to land and, in certain circumstances, legal native title rights, presents a unique consideration in the contemporary Australian debate about nuclear energy and waste management.⁴⁸

The South Australian Royal Commission refers to these considerations. It notes, particularly in relation to the State's context, the historical events that occurred at Maralinga, South Australia, in the 1950s. Nuclear weapons testing, which caused serious health impacts, are reported to have led to "deep scepticism" about the ability of government to ensure that any new nuclear activities would be undertaken safely.⁴⁹ In the 1950's the general public was unaware of the medical impacts of the nuclear weapon's testings. That is not the case in 2016.

7. Conclusion

Due to the current prohibition and necessary amendments to legislation, Australia is unlikely to produce energy from nuclear resources in the near future. Consequently there is no legislation or policy regulating nuclear power plant development and operations.

Current debate and movement in the area relates to the process of locating a permanent national site for nuclear waste storage and disposal for local low and intermediate radioactive waste, pursuant to the NRWM Act.

It can be argued that once storage and disposal are managed appropriately, Australia may begin to further the current debate of realising a reduction in greenhouse gas emission targets through the assistance of nuclear power to some extent. Australia is faced with unique considerations including the availability of uranium and safe geological conditions, as well as local cultural and environmental considerations. Nonetheless, Australia's undertaking to reduce its carbon emissions may speed up the implementation of nuclear energy.

⁴⁷ Ibid, 92.

⁴⁸ See for example, Graetz, G 'Energy for whom? Uranium mining, Indigenous people, and navigating risk and rights in Australia' *Energy Research & Social Science* 8 (2015) 113-126.

⁴⁹ Ibid, 125.