MINERALS COUNCIL OF AUSTRALIA

SUBMISSION TO VICTORIAN LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

INQUIRY INTO REMOVING PROHIBITIONS ENACTED BY THE NUCLEAR ACTIVITIES (PROHIBITIONS) ACT 1983

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EXECUTIVE SUMMARY

The MCA welcomes the opportunity to respond to the Victorian Legislative Council Environment and Planning Committee's inquiry on potential benefits to Victoria in removing prohibitions enacted by the Nuclear Activities (Prohibitions) Act 1983 (the Act).

The Nuclear (Prohibitions) Act is damaging Victoria today

The Act is no longer relevant for modern society. It represents a state-based response to nuclear proliferation which has been effectively managed by the Commonwealth of Australia. More importantly, the Act is impeding Victoria in two critical areas.

- Emerging industries, particularly those identified as priority sectors by the Victorian government including food processing, medical and space technologies, and the development of value-adding down-stream processing of critical minerals.
- The ability to consider zero emission 24/7 electricity capable of meeting the needs of Victorian industry, households and communities

By imposing restrictions on the exploration and mining of uranium and nuclear energy, Victoria is short-changing its citizens.

The MCA has consistently advocated for the repeal of federal and state-based bans on nuclear power, uranium exploration and mining.

There is no justification for the continued prohibition of nuclear power in Victoria

Nuclear power was prohibited in Victoria more than three decades ago based on even older community sentiment. This ban preceded the mainstream understanding of climate change and potential mitigation solutions.

Repealing the Nuclear Activities (Prohibitions) Act 1983 along with the repeal of the nuclear energy ban in the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is critical if Victoria and Australia are to seriously embrace all technologies so our future energy mix is affordable, reliable and clean.

Similarly, lifting the prohibition on uranium mining is critical to not just removing discrimination against uranium mining, but also as part of a broader recognition that Victoria and Australia acknowledge uranium-fuelled nuclear energy to reduce greenhouse gas emissions.

Small Modular Reactors could provide zero emissions affordable 24/7 power for Victorian industry

The resources sector is central to Victoria's energy transition, particularly as the sector provides the commodities which underpin the renewables sector. Still, Victoria is facing serious issues with its power supply.

Nuclear energy must be considered as part of the energy mix if Victoria is to retain and grow a strong industrial sector with high-paying long-term jobs, particularly in regional and outer suburban areas while also significantly reducing greenhouse gas emissions.

The close of Hazelwood power station in 2017 saw wholesale electricity prices increase by around 80 per cent. While wholesale electricity prices have started to fall, there remains ongoing concern around the ability to meet electricity demand.[1]

Managing the integration of increasing levels of renewable energy sources remains a significant challenge, with more work required to ensure transmission and network security. In this context, Small Modular Reactors, which will be commercially available by the late 2020s, could, along with CCS-ready coal or gas plants, replace retiring coal generators as well as complementing intermittent renewable energy sources.

[1] Australian Energy Regulator, Wholesale Markets Quarterly Q4 2019, 15 February 2020, p.8

Once manufacturing has been established, the Levelised Cost of Electricity (LCOE) from SMRs could be as low as around A$60/MWh. This would likely make SMRs the cheapest zero emissions power source capable of providing 24/7 energy of any technology.

ISSUES

The Nuclear Activities (Prohibtions) Act is damaging Victoria today

The Nuclear Activities (Prohibitions) Act 1983 (the Act) is outdated. The Act represents a state-based response to a problem which is managed by the Commonwealth of Australia.

More importantly, the Act is impeding Victoria as it attempts to foster emerging industries, particularly those identified as priority sectors by the Victorian government including food and fibre, medical and space technologies and critical minerals.

The Victorian government has identified a number of priority industries and sectors which will underpin economic growth and jobs.[2] Among these, food and fibre, along with medical/pharmaceuticals and space technologies are those which are impacted by the Act.

Nuclear related technologies are increasingly important for each of these. Food processing uses irradiation to improve the shelf life of food by destroying bacteria, moulds and insects.[3]

Nuclear medicine is a critical part of modern medicine.

The Lucas Heights Open Pool Australian Light Water (OPAL) reactor in suburban Sydney is producing nuclear medicines that are central to the diagnosis, treatment and prevention of many diseases. It produces around 10,000 doses per week which are used by 250 medical facilities in Australia and New Zealand.[4]

On average, one in two Australians will need a nuclear medicine scan during their lifetime. These are used to diagnose heart, thyroid, lung, and kidney conditions, along with tumours, fractures and sporting injuries.[5] About one-third of all hospital procedures involve radiation or radioactivity.

The recent completion of the Mo-99 Manufacturing Facility at Lucas Heights will see Australia become a major player in international health care. Molybdenum 99 (Mo-99) is used in 80 per cent of nuclear medicines, particularly the diagnosis of cancers, heart disease, muscular and skeletal conditions. The new facility will meet all of Australia's needs and is capable of supplying 25 per cent of global demand.[6]

Importantly, the OPAL reactor and the regulatory framework supporting it shows Australia can develop capability and safely operate nuclear technology.

Yet Victoria, which views medical and pharmaceuticals as a priority industry, is effectively stopping itself from fully participating in the sector.

Similarly with space technologies, nuclear power is a critical power source for space travel.[7] The Act limits the potential development of this industry in Victoria.

The Act creates uncertainty for investors in downstream mineral processing. This puts at risk potential value-adding activities in Victoria and the state's ability to be a global supplier of high grade mineral sands and rare earth elements. In particular, it undermines the Victorian government's push to create a renewable energy value- chain focused on the production of hybrid cars, electric vehicles

[2] Department of Jobs, Precincts and Regions, Priority Industry Sectors - https://djpr.vic.gov.au/priority-industries-sectors
[3] Victorian Government, https://www.betterhealth.vic.gov.au/health/HealthyLiving/food-irradiation.
[4] ibid
[5] Australian Nuclear Science and Technology Organisation, Benefits of Nuclear Science - https://www.ansto.gov.au/education/nuclear-facts/what-is-nuclear-science#content-the-benefits – accessed 10 September 2019.
[6] Australian Nuclear Science and Technology Organisation, Nuclear Medicine Project - https://www.ansto.gov.au/business/products-and-services/health/services/ansto-nuclear-medicine-project - accessed 10 September 2019.
[7] World Nuclear Association, Nuclear Reactors and Radioisotopes for Space, July 2019 - https://www.world-nuclear.org/information-library/non-power-nuclear-applications/transport/nuclear-reactors-for-space.aspx,

and wind turbines. Imposing unnecessary hurdles for this emerging and important Victorian industry harms opportunities for the economic growth and diversification of regional communities.

There is no justification for the continued prohibition of nuclear energy in Victoria

Nuclear power was prohibited in Australia two decades ago based on sentiment from four decades ago, preceding the mainstream understanding of the threat of human induced climate change and potential mitigation solutions.

Repealing the legislated ban on nuclear energy in Victoria and federally under the EPBC Act is critical if Victoria and Australia are to seriously embrace all technologies so the future energy mix is affordable, reliable and cleaner.

Similarly, the duplicative approvals process for uranium projects under the EPBC Act and the Victorian prohibition on uranium mining treat uranium differently from any other mineral and are not justified.[8]

With its ban on uranium mining, Victoria effectively sends a message there is no point in investors considering Victoria in relation to uranium. Similarly, the nuclear prohibition sends the same signal to Victorian institutions who could look to replicate the skills and expertise currently found in NSW-based institutions.

Removing these bans would send a broader message that Victoria and Australia recognise uranium-fuelled nuclear energy as a critical part of global efforts to reduce greenhouse emissions.

Some 10 per cent of the world's power comes from nuclear energy[9]. For 30 years, nuclear has been the biggest low carbon source of electricity for developed countries, providing 18 per cent of all electricity[10].

Nuclear energy's low life cycle emissions profile is widely recognised. As the South Australian Royal Commission found in 2016, nuclear energy's greenhouse emissions are comparable to solar PV and wind farms.[11]

Unlike weather-dependent renewable energy sources, nuclear energy can provide zero emissions power 24/7, 365 days a year.

In 2017, global nuclear power resulted in about 2.2 billion tonnes of CO_2 not being released into the atmosphere.[12] This is almost four times Australia's total greenhouse emissions. Without nuclear, global electricity sector emissions would have been 6 per cent higher.[13]

The International Panel on Climate Change (IPCC) in its 1.5 degree report from October 2018 indicated nuclear energy would, depending on scenario, have to increase by between 1.5 to 5 times by 2050 (compared to 2010).[14]

The Act effectively means Victoria is out of step with international views that nuclear energy will play an important role in reducing greenhouse gas emissions. It also denies Victorians the opportunity to consider the one source of energy production which can meet industrial, household and community demand for affordable 24/7 power with zero emissions.

Victoria needs to consider all energy options to ensure its status as a manufacturing state

Over the past decade household and industrial electricity costs in Australia have risen by more than 90 per cent.[15] This is driving jobs and prosperity from Australia as businesses seek to make major

[8] L Wilkinson, *Mining and the EPBC Act nuclear actions trigger*, MCA Publication, October 2018
[9] International Energy Agency, *Nuclear Power in a Clean Energy System*, May 2019, p.3.
[10] ibid, p.2.
[11] *South Australian Nuclear Fuel Cycle Royal Commission – Final Report 2016*, Adelaide, 2016, p. 3
[12] International Atomic Energy Agency, *Climate Change and Nuclear Power 2018*, pp.45-46.
[13] MCA calculation based on total electricity sector emission and saved emissions from nuclear power.
[14] IPCC, 2018: *Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. p. 14

investments in other countries where energy is affordable and reliable.[16] In November 2017, the U.S. state of Pennsylvania targeted Australian manufacturing firms with offers of cheaper and more reliable energy based on low cost gas.[17]

Reducing energy costs is critical, particularly if Victoria is to maintain and increase the number of high-paying jobs in manufacturing where energy is a major input. Many of these jobs are, or would be, located in regional Victoria and outer urban areas.

Victoria has relied for its development and prosperity on large baseload power generators – mostly coal generators – to provide affordable and reliable energy for industry, households and communities.

These baseload power stations provide power 24/7 hours a day which is essential for business operations such as mining. However, these coal plants are ageing, with an average age of 34 years, and the cost of maintaining them is increasing.

The MCA has estimated that at least 8,000MW of low-cost baseload will close by 2030, if not earlier.[18] This includes Liddell and Vales Point power stations in New South Wales, Yallourn in Victoria and Gladstone C in Queensland, together representing about 30 per cent of Australia's current baseload generation. Further closures are expected in the early 2030s.

At this stage, it is unclear what will replace these retiring generators and at what cost. Closures of large baseload plants have already led to significant price rises. When Hazelwood Power Station in closed in 2017, wholesale prices jumped 80 per cent.[19]

Unless significant new power generation capacity is provided which is capable of meeting the needs of Victorian industry for affordable and reliable power available 24/7, Victoria will increasingly find itself struggling to compete against other countries where energy costs are lower. This will mean fewer jobs for workers, particularly in regional and outer suburban areas.

The MCA has consistently advocated for energy policy based on technology neutrality. This means that all technologies should be considered, including renewables, nuclear, low emission coal and gas along with carbon capture and storage. This would allow a mix of energy supplies that would provide NEM grid stability while meeting emissions reduction objectives.

In this context, Small Modular Reactors can play an important role in restoring a cost competitive, plentiful and reliable supply of energy to Victoria.

SMRs can meet the needs of Victorian industry, households and communities

The development of SMRs is one of a number of technological and production innovations in nuclear technologies that will transform how nuclear power is provided worldwide.

SMR designs closest to commercial deployment are an evolution of a proven mature technology – smaller, cheaper and more flexible than large-scale nuclear reactors. SMRs are currently undergoing regulatory approval in the United States and Canada, along with other countries.

SMRs benefit from inherent design and manufacturing processes which will make them cost competitive with other 24/7 generation sources. Fabrication in factories to a single design provides for economies of scale.

Smaller than traditional nuclear power plants, SMRs will fit better with the emerging energy market in Australia and Victoria where a higher level of intermittent resources creates a need for smaller, flexible load-following generation supplies. In some cases, SMRs would be more highly valued than traditional baseload.

[15] Australian Bureau of Statistics, cat. no. 6401, *Consumer Price Index, Australia, Jun 2019*; cat. no. 6427, *Producer Price Index, Australia, Jun 2019*.
[16] For example, Bluescope Steel's 19 August 2019 announcement that it would invest $1 billion in its Ohio's steel works because of cheap energy costs.
[17] The Australian, *US state of Pennsylvania spruiks power to entice Aussie firms*, 28 December 2017.
[18] Minerals Council of Australia, *Submission to the Department of Environment and Energy's Underwriting New Generation Investments consultation paper*, November 2018, p. 3.
[19] Australian Energy Regulator, *Quarterly volume weighted average spot prices*, viewed 13 September 2019.

SMRs can also work as baseload generators. For instance, US-based NuScale – which is one of the SMR companies closest to commercial deployment – is designing its SMRs to operate in packs of six or 12 modules totalling 360-720 MW.

SMRs of this size would meet the energy needs of any large industrial user in Australia requiring 24/7 power.

A 360MW SMR would meet the electricity demand of both Geelong and Ballarat.[20]

SMRs represent one of the cheapest new build 24/7 power supplies of any technology. In Australia, this would possibly make SMRs the cheapest zero emission power source capable of providing 24/7 energy.

Table 1 compares the LCOE in 2030 of SMRs operating 90 per cent of the time, with a Combined Cycle Gas Turbine operating at between 40-80 per cent of the time, along with wind and solar combined with 6 hours of pumped hydro storage and coal and gas with CCS.

Table 1: Cost comparison of different electricity sources in 2030

Power generation type	Cost in Australia (A$/MWh)
SMR	$60-$110 [21]
Gas (40-80% load)	$75-$125 [22]
Wind + 6 hrs storage	$75-$110 [23]
Solar + 6 hrs storage	$55-$80 [24]
Coal + CCS (40-80% load)	$145-$230 [25]
Gas + CCS (40-80% load)	$125-$190 [26]

The LCOE allows comparison of different types of electricity generation on a consistent basis by determining the average total cost to build and operate a power-generating asset over its lifetime divided by the total energy output of the asset over that lifetime.

However, its fundamental shortcoming is that it fails to indicate when power is produced. System costs of back-up, storage and ancillary services are required to ensure grid stability and the reliable provision of power and needs to be factored in to each type of generation cost.

This is why 24/7 power produced by nuclear, coal and gas can be cheaper on a system cost basis because it reduces the need for back-up supplies and storage while also providing the full range of ancillary services.

GenCost 2018 also considered SMRs. However, the capital cost attributed to SMRs of $16,000/KW cannot be validated and appears to be at least 2-3 times that cited elsewhere. For example, NuScale estimates the capital cost of large-scale fabrication (which leads to lower costs) would be US$3,600/KW or A$5,140/KW.[27] The Canadian SMR Roadmap also provided a range of estimates, with the average just under C$7,200/KW (A$7,500/KW).[28]

[20] Based on a comparable population of Canberra (around 400,000) whose electricity demand in 2018 was 2.8TWh – ACT Government, *ACT Sustainable Energy Policy 2020-2025*, p.9. Calculation based on a 360MW SMR operating at 90 per cent capacity factor.
[21] Economic & Finance Working Group, *SMR Roadmap*, December 2018. Figure 1, p. 19
[22] PW Graham, J Hayward, J Foster, O Story, & L Havas, *GenCost 2018*. Australia, 2018, p29.
[23] ibid
[24] ibid
[25] ibid
[26] ibid
[27] NuScale Energy, Submission to the NSW Standing Committee on State Development – Inquiry the Uranium Mining and Nuclear Facilities (Prohibitions) Repeal Bill 2019, p.17.
[28] Economic & Finance Working Group, *SMR Roadmap*, pp-55-58, op. cit.

OTHER ISSUES

Nuclear energy and uranium mining are safe

The safety of workers and the communities in which the minerals sector operates is the industry's number one priority.

Nuclear energy has generated electricity safely since the first commercial reactor began operation in the UK in 1956.[29]

With more than 17,000 cumulative reactor years over the past six decades, nuclear energy generation has resulted in fewer accidents and many fewer deaths and worker injuries than other energy generation sources.[30]

This includes the aftermath of the earthquake and tsunami which hit Fukushima in 2011. Although tragically 16,000 deaths were attributed to these natural disasters, there were no deaths from radiation exposure in the immediate aftermath.[31]

The South Australian Royal Commission considered the issue of safety in detail and found that:

> Data from modern nuclear fuel cycle facilities demonstrates they operate well within the applicable regulatory limits for workers, the public and the environment. Doses of radiation to the local community from any new nuclear facilities in South Australia could be expected to be in the range of those estimated from the international nuclear facilities.[32]

Finally, the uranium industry's radiation protection safety performance is actively monitored by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

The natural level of radiation for an Australian is 1.5 milliSievert (mSv) per year.[33]

In its 2019 Australian National Radiation Dose Register (ANRDR) provides a report on the extensive monitoring of the radiation exposure for uranium and other workers. The report confirms the low relative doses of radiation of 1 mSv per year, lower than aircraft crew at 3.5 mSv per year[34] and well short of the maximum dose permitted of 20 mSv per year averaged over five years and not more than 50 mSv in any one year.

Environmental impacts of uranium mines

Australia's uranium mines deliver world-leading environmental performance. An overview of the sector's performance was conducted in 2017 by Dr Ben Heard for the MCA.[35]

Key points from that review include:

- It is the nature and regulation of the mining practice, not the mineral, that determines the environmental outcome[36]
- Australia's modern uranium mining industry is world class, and accordingly delivers world class environmental outcomes.

The OECD Nuclear Energy Agency also closely considered this issue in its 2014 report. It concluded:

Uranium mining remains controversial principally because of legacy environmental and health issues created during the early phase of the industry. Today, uranium mining is conducted under significantly

[29] World Nuclear Association, *Pocket Guide 2019-2020*, London, 2019, p. 32
[30] World Nuclear Association, *Safety of nuclear power reactors*, London, 2018
[31] World Health Organisation, *FAQS: Fukushima five years on*, WHO, viewed 10 September 2019, https://www.who.int/ionizing_radiation/a_e/fukushima/faqs-fukushima/en/
[32] South Australian Nuclear Fuel Cycle Royal Commission – Final Report, op cit. p. 135.
[33] Australian Radiation Protection and Nuclear Safety Agency, *ANRDR in Review 2019*, ARPANSA https://www.arpansa.gov.au/sites/default/files/anrdr_in_review_2019.pdf. - viewed 10 September 2019,
[34] ibid, p.29.
[35] B Heard, *Environmental impacts of uranium mining in Australia: History, progress and current practice*, policy paper commissioned by the MCA, 2017, viewed 10 September 2019, .https://minerals.org.au/sites/default/files/Environmental%20impacts%20of%20uranium%20mining%20in%20Australia_May%202017_WEB.pdf
[36] ibid, p. 5.

different circumstances and is now the most regulated and one of the safest forms of mining in the world.[37]

Nuclear power is the only energy source which deals with its own waste

Nuclear energy creates radioactive waste. Its management is tightly regulated nationally and globally. Classified as either high, intermediate or low level, it comprises everything from lightly contaminated tools and medical waste through to highly radioactive spent nuclear fuel.

Globally, 90 per cent of all nuclear waste is classified low level, with seven per cent intermediate and three per cent high level.[38]

Radioactivity dissipates over time. After 40-50 years the radioactivity of spent nuclear fuel falls to 1/1000th of the level at its removal from the reactor. After 1,000 years it has the same radioactivity as naturally-occurring uranium ore.[39]

Spent nuclear fuel can be handled and safely stored initially by cooling in water and then being placed into dry-ventilated concrete casks. It can then be disposed in deep geological repositories such as that being built in Finland, or reprocessed as occurs in France.

Emerging technologies such as Generation IV fast reactors could use high level waste as a fuel source.[40]

[37] OECD-NEA, *Managing Environmental and Health Impacts of Uranium Mining*, Paris 2014, p. 9.
[38] World Nuclear Association, *What are nuclear wastes and how are they managed* - www.world-nuclear.org/nuclear-basics/what-are-nuclear-wastes.aspx – accessed 10 September 2019.
[39] World Nuclear Association, *Radioactive Waste Management* - www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx – accessed 10 September 2019.
[40] World Nuclear Association, *Fast Neutron Reactors* - www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/nuclear-power-reactors.aspx - – accessed 10 September 2019.