

World Nuclear Association submission to the Victorian Parliament's *"Inquiry into nuclear prohibition"*

This World Nuclear Association submission reflects the views of industry experts, but does not necessarily represent the views of any of the Association's individual member organisations.

For the attention of the Environment and Planning Committee of the Parliament of Victoria:

The World Nuclear Association is pleased to see that the Parliament of Victoria is considering the potential benefits to Victoria in removing prohibitions enacted by the Nuclear Activities (Prohibitions) Act 1983. In our opinion:

- The uranium and thorium mining ban is out of date and impedes Victoria, Australia and other countries from achieving their decarbonisation objectives.
- The mining ban prevents Victoria from benefiting from potentially lucrative exports and the well-paid employment opportunities associated with such mining activities.
- There is no environmental or public health justification for banning these mining activities
- Victoria would in fact benefit substantially if it were to begin a nuclear energy programme and should harmonise with national laws

We expand upon these points below, although we do not address thorium since uranium is of primary importance to the nuclear industry. We would be happy to take part in any public hearing the Inquiry would like to arrange via video- or teleconference.

The current law is out of date and undermines decarbonisation in Australia and globally

Around the world over 30 countries¹ representing about two thirds of the world's population are now using nuclear energy, with about another 30 countries² considering, planning or starting nuclear programmes. There is a global transition underway to a low-carbon future and many countries have decided that nuclear energy must be part of their climate solution. They need uranium to fuel their reactors, a resource that has been found in abundance in other Australian states and is now being mined and exported – and which may exist in Victoria.

We support the Victorian government in its aspiration of reaching net-zero carbon by 2050. However, given this ambition to protect the climate it is astounding that the state continues to permit the mining of lignite in vast quantities from the Latrobe valley, while banning uranium mining activities which would support decarbonisation efforts abroad by way of fuelling nuclear reactors. Nuclear energy has one of the lowest lifecycle emissions of any energy technology – approximately the same as wind energy as is clearly acknowledged by the Intergovernmental Panel on Climate Change (see Figure 1).

It should be noted that while the main use of uranium is for power production it can also be used to create radioisotopes for life-saving medical procedures. Globally, over 40 million nuclear medicine procedures are performed each year, and demand for radioisotopes is increasing by 5% annually³. Radioisotopes are also used in agriculture, consumer products, food, transport and water management applications⁴.

Furthermore, the extremely rigorous and comprehensive South Australian Nuclear Fuel Cycle SANFC Royal Commission⁵ recommended that the South Australian government pursue *“the simplification of state and*

¹ World Nuclear Association, [Nuclear shares figures, 2008 – 2018](#)

² World Nuclear Association, [Emerging Nuclear Countries](#)

³ World Nuclear Association, [Radioisotopes in Medicine](#)

⁴ World Nuclear Association, [The Many Uses of Nuclear Technology](#)

⁵ South Australia Nuclear Fuel Cycle Royal Commission, May 2016, [Nuclear Fuel Cycle Royal Commission Report](#)

federal mining approval requirements for radioactive ores, to deliver a single assessment and approvals process” in order to avoid the unnecessary duplication of approvals. Victoria should support this same national harmonization effort, as indeed should every Australian state.

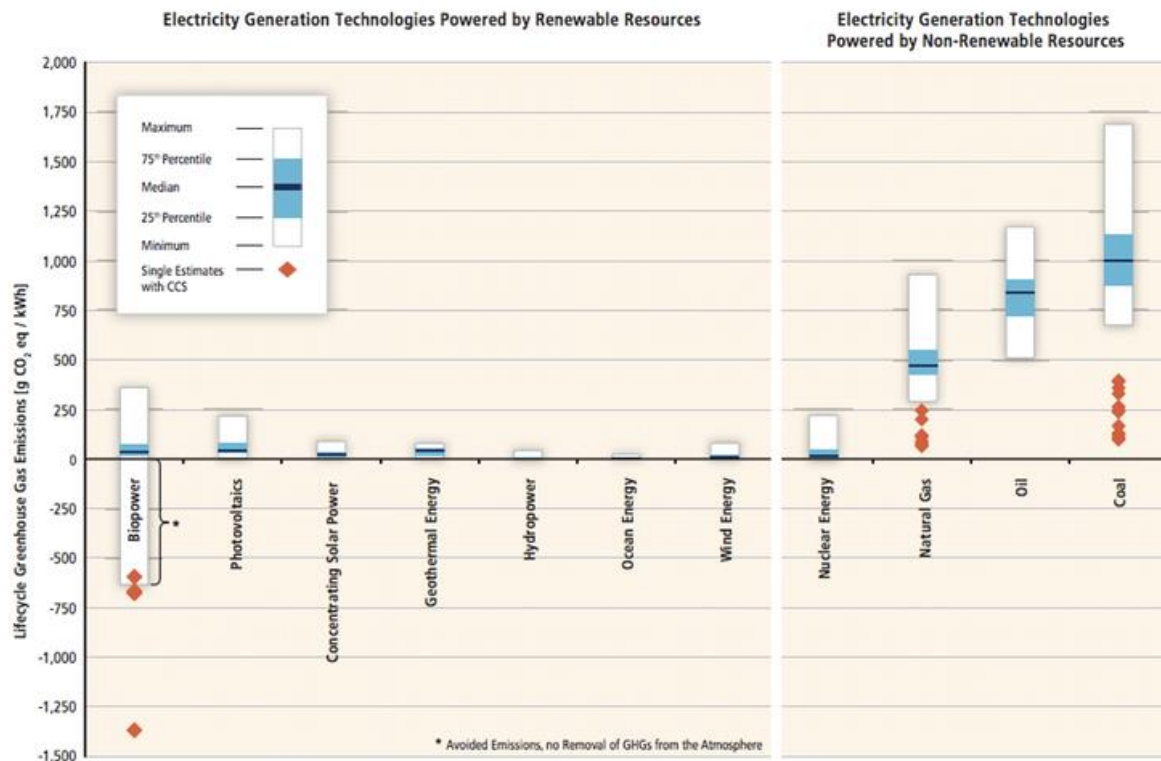


Figure 1. Life cycle emissions of different energy technologies reported by the IPCC⁶

Uranium mining is profitable and generates high-paying jobs.

The Minerals Council of Australia⁷ notes that: “Australia exported 6227 tonnes of uranium in 2017-18 – just under 10 per cent of world demand – valued at \$575 million. Today the industry employs 3000 people.” According to employment website PayScale the average annual salary for uranium workers is AUD 103,000. These are well-paying jobs which will help to support regional economies.

Four of Australia’s six approved uranium mines are in South Australia, where the Department for Energy and Mining notes that uranium is one of the state’s biggest mineral commodities and that: “In the past decade (2007–2016) uranium mining has contributed more than \$3.5 billion in export revenue to the South Australian economy, and \$141 million in royalties to South Australians.”⁸

⁶ IPCC, 2011, [SRREN](#)

⁷ MCA, 2019, [Untapped Potential – Australia’s rich endowment](#)

⁸ SA Department for Energy and Mining webpage on uranium, accessed January 2020
http://energymining.sa.gov.au/minerals/mineral_commodities/uranium

For the past several years the global market for uranium has been somewhat depressed and prices kept low due to short term over-supply. However, nuclear energy is growing and so is the future demand for uranium. The World Nuclear Association regularly reports on the status of the nuclear fuel market and produces supply and demand scenarios as part of its biennial nuclear fuel report. In last year’s edition it was evident that there is increasing optimism about future nuclear energy prospects with uranium demand doubling by 2040 in the upper scenario. Given that it may take ten years or even more to bring a new mine into production now is a good time to permit exploration activities.

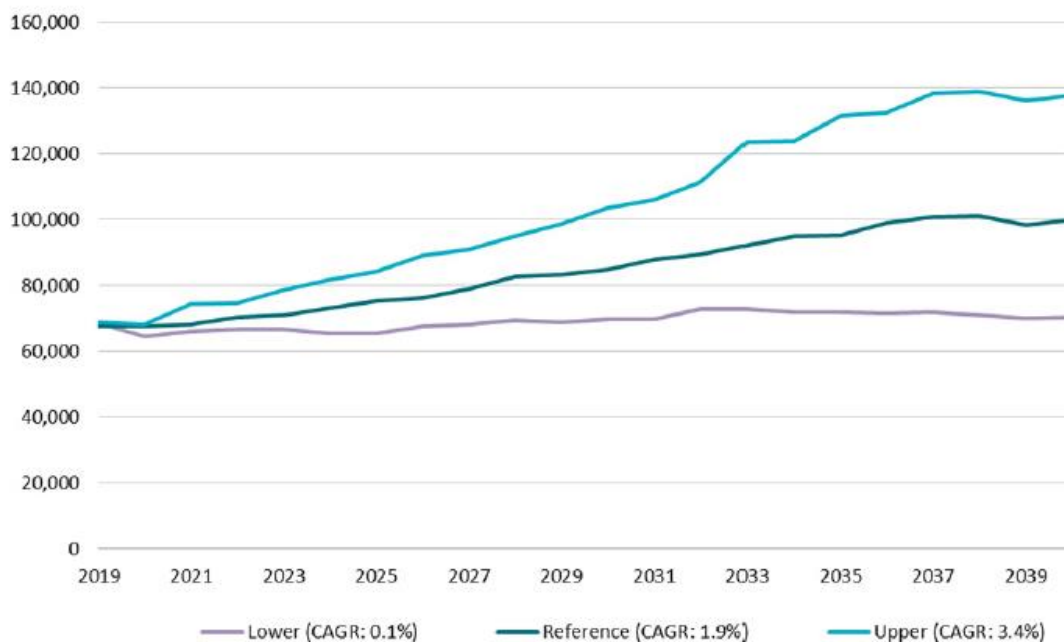


Figure 2 Global uranium reactor requirement (tonnes of uranium) scenarios to 2040. Source: WNA Fuel Market Report⁹

A final economic incentive for Victoria to remove the uranium mining ban is that it may be the decisive factor that makes other non-uranium mining activities viable. Uranium is often found alongside other valuable minerals such as gold, copper, phosphates and even coal. The prime example of this is the Olympic Dam mine in South Australia. This is primarily a copper mine but the miners also extract uranium as well as gold and silver. The alternative to extracting the uranium would be disposing of it in tailings. This adds to operating costs and reduces the sustainability of mining operations.

There are no environmental or public health justifications for banning uranium mining

In many respects the risk management considerations of uranium mining are much the same as for any other mining. Projects must receive environmental approvals prior to beginning development, and must comply with all environmental, safety and occupational health requirements set by regulators. Increasingly, these are governed by international standards and subjected to external audits. For example, most uranium mines in Australia and Canada have ISO 14001 certification.

⁹ WNA, 2019, [The Nuclear Fuel Report Global Scenarios for Demand and Supply Availability 2019-2040](#)

While no justification for the uranium mining ban is provided in the Nuclear Activities Prohibition Act of 1993 we suspect that it relate to fears over radiation and potential environmental contamination. However uranium itself is not particularly radioactive. Uranium mining and milling does produce radioactive tailings and by-products which need to be managed and worker doses need to be monitored but the same is true for many minerals. In an interesting twist the world's leading body of radiation experts, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), recently concluded that¹⁰:

"...The largest collective dose to workers per unit of electricity generated resulted from coal mining, because of exposures to naturally occurring radionuclides. Of all the collective doses evaluated, both to the public and to workers, the exposure of workers from coal mining made the largest contribution, although it has fallen over time because of improving mining conditions. With regard to the construction phase of the electricity-generating technologies, by far the largest collective dose to workers per unit of electricity generated was found in the solar power cycle, followed by the wind power cycle. The reason for this is that these technologies require large amounts of rare earth metals, and the mining of low-grade ore exposes workers to natural radionuclides during mining."

To put real numbers on this, the Mineral Council reports¹¹ that 95% of occupationally exposed Australian workers recorded an average annual dose of less than 3 milli Sieverts (mSv) in 2018, while 72% recorded a dose of less than 1 mSv. This comes in well beneath a maximum permitted dose limits set by the regulator ARPANSA of 20 mSv per year averaged over five years, and not more than 50 mSv in any one year. In other words, Australian uranium mining practices are certainly high enough to protect people and the environment. For more details on modern uranium mining health and environmental protection practices readers may wish to consult OECD NEA¹² and World Nuclear Association's online information resources¹³.

At the end of its productive life an uranium mine needs to be decommissioned and the landscape rehabilitated, but here too Australia has direct experience which Victoria could draw on. Mary Kathleen in Queensland was the site of Australia's first major rehabilitation project of a uranium mine. The rehabilitation project was completed at the end of 1985 at a cost of some \$19 million, and won an award for engineering excellence. The Nabarlek uranium mine in the Northern Territory, was the first of the "new generation" of uranium mines to commence operations and the first to be rehabilitated. Environmental protection was stressed at Nabarlek since before mining commenced, and everything proceeded with eventual rehabilitation very much in mind. During the life of the operation the company worked together with government agencies, the Northern Land Council (NLC) and Aboriginal land owners to ensure a high standard of environmental management, culminating in its decommissioning and successful rehabilitation.

The World Nuclear Association has long recognised the need to build trust in the management of uranium mining activities. In 2017 we published an internationally standardized reporting tool to understand the sustainable development performance of uranium mining and processing sites¹⁴. This checklist had been

¹⁰ UNSCEAR, 2016 (published 2017), [Sources, Effects And Risks Of Ionizing Radiation](#)

¹¹ See reference 6

¹² OECD Nuclear Energy Agency, 2014, [Managing Environmental and Health Impacts of Uranium Mining](#)

¹³ World Nuclear Association, [Environmental Aspects of Uranium Mining](#)

¹⁴ World Nuclear Association, 2017, [Internationally Standardized Reporting on the Sustainable Development Performance of Uranium Mining and Processing Sites](#)

developed by our members - including Australian mining companies such as BHP - over several years with the goal of achieving widespread agreement on a list of topics and indicators for common use in demonstrating producers' adherence to sustainable development performance.

In other words, we believe that industry has done its part to dramatically improve the sustainability and safety of uranium mining operations. It would be good to see Victoria's laws updated to reflect that and to see the state pursue harmonisation with national laws.

Nuclear power plants make sense for Victoria

This inquiry presents the perfect opportunity for Victoria to harmonise its own laws with federal law. Regarding the construction of nuclear facilities, this would mean removing section 8 of the Prohibitions Act since it is already contained within section 140A of the federal Environment Protection and Biodiversity Conservation (EPBC) Act of 1993. There is simply no good reason why Victoria should either duplicate or be at odds with federal law.

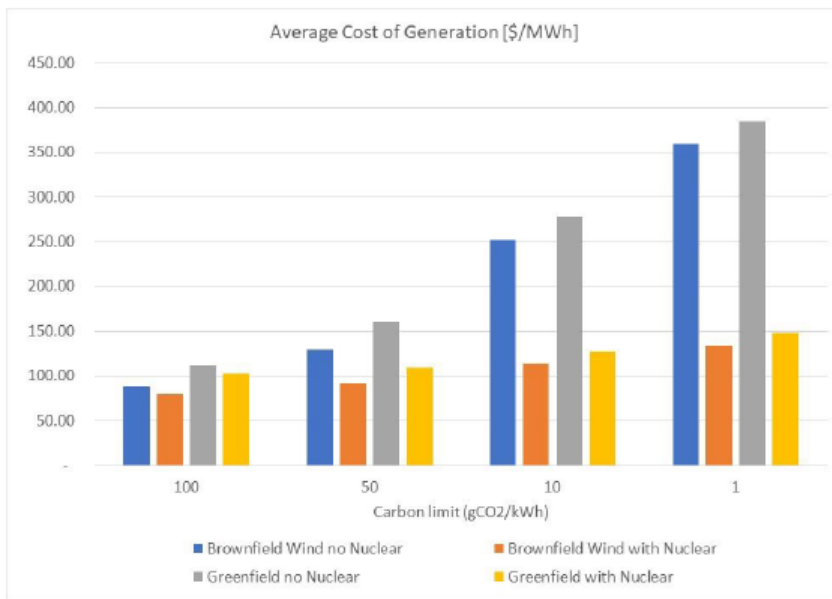
On this point it is worth noting that the eventual removal of the federal ban on nuclear power plants is a distinct possibility. The federal Inquiry into the pre-requisites for nuclear energy in Australia just published its final report¹⁵ and recommended – after careful investigation – the lifting of the federal ban on nuclear energy for advanced reactors. The extremely rigorous and comprehensive South Australian Nuclear Fuel Cycle SANFC Royal Commission also recommended¹⁶ that the state pursue *“removal at the federal level of existing prohibitions on nuclear power generation to allow it to contribute to a low-carbon electricity system, if required”*.

Exploring this further, there are many benefits on offer if Victoria was to develop nuclear power plants to replace the brown coal power plants that it currently depends on to meet the vast majority of its electricity needs. The first of these is that adding nuclear to the mix should help to reduce the consumer energy costs relative to future decarbonisation pathways where it is excluded. There is a scarcity of quality modelling which seriously consider nuclear energy in an Australian context – let alone a Victorian one – however two recent white papers are noteworthy. One from MIT researchers¹⁷ (figure 3, below) modelled the future South Australian mix and found that nuclear was clearly part of the lowest cost scenario, with the amount of nuclear capacity increasing as carbon intensity limits were set lower. The cost escalation seen in the no-nuclear scenarios with aggressive carbon constraints is mostly due to the additional build-out and cost of energy storage, which become necessary in scenarios that rely exclusively on variable renewable energy technologies. The report surmised that *“similar results would apply to other Australian states as well as the country as a whole”*.

¹⁵ Parliament of Australia, 13 December 2019, [Not without your approval: a way forward for nuclear technology in Australia](#)

¹⁶ South Australia Nuclear Fuel Cycle Royal Commission, May 2016, [Nuclear Fuel Cycle Royal Commission Report](#)

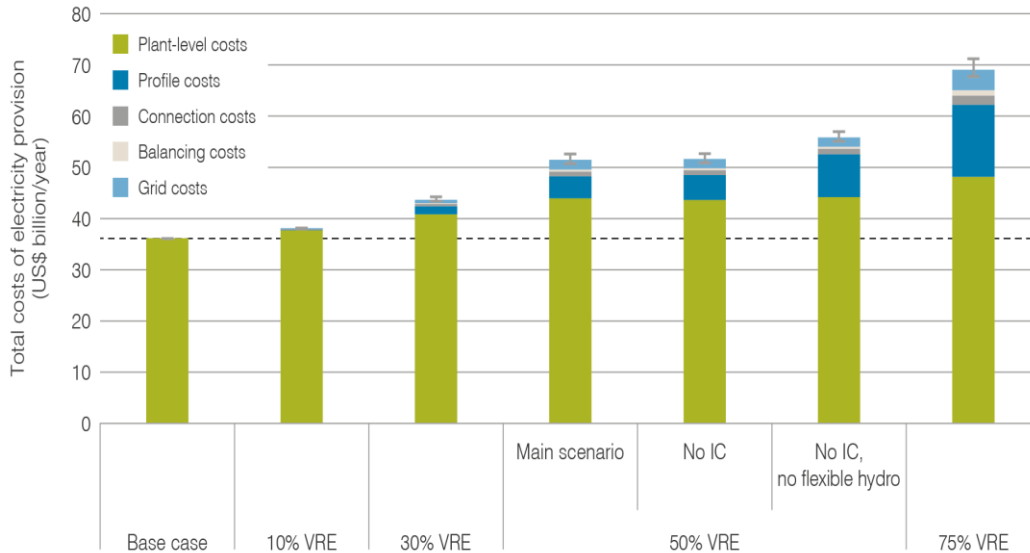
¹⁷ Buongiorno et al, 2018, [Potential Applications of the Modern Nuclear Fuel Cycle to \(South\) Australia](#)



The inclusion of nuclear power in the electricity mix is the most cost-effective option, especially when pursuing decarbonisation policies.

Figure 3: Average system cost of electricity (in USD \$/MWh) in South Australia for different carbon constraints (gCO₂/kWh) and four scenarios¹⁸.

A study by the OECD-Nuclear Energy Agency (see figure 4, below) similarly concluded that the higher the proportion of variable renewables in the electricity mix, the higher the overall costs¹⁹. The second comes from



These costs are compared with fully-dispatchable generation

Figure 4: System costs of different electricity mixes

consultancy Fraser Nash²⁰ and looks at cost optimisation of the National Electricity Market (NEM) in decarbonisation scenarios (<100 g CO₂/kWh) where nuclear energy is allowed to played a role and the over-

¹⁸ Ibid.

¹⁹ OECD-Nuclear Energy Agency, 2019, [The Cost of Decarbonisation: System Costs with High Shares of Nuclear and Renewables](#)

build of renewables is minimised. In all three cases presented the amount of nuclear capacity in the NEM grew to at least 15 gigawatts even when the levelised costs of wind and solar are much lower than nuclear. Where deep decarbonisation is the aim, including nuclear energy helps to cut costs dramatically. Additionally, experiences from China clearly highlight that nuclear has the cheapest option for low-carbon electricity when comparing the levelised costs of electricity, as clearly seen in figure 5.

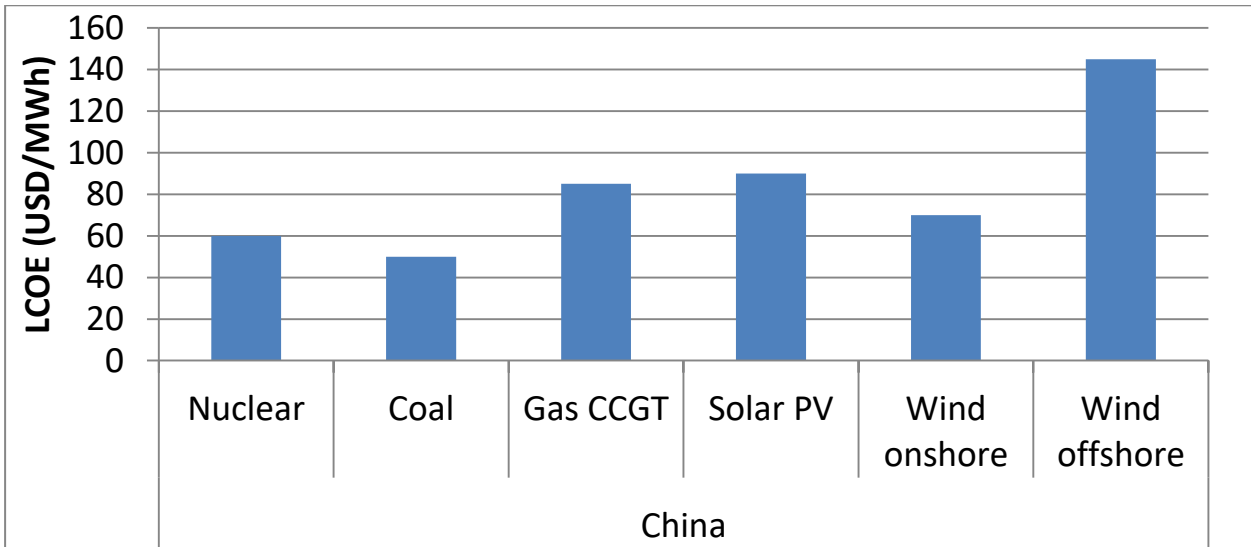


Figure 5: Levelised cost of electricity in China²¹

Nuclear power plants are highly reliable, capable both of operating in ‘base load’ mode (capacity factors in excess of 90%) and load following if desired. In other words, they fill a similar role to coal power plants in the mix and are the perfect low-carbon substitute for them. Nuclear power plants are a complementary partner to renewable energy sources. They provide dispatchable electricity at low, stable operating costs and would help to protect against blackouts and price surges which the state has recently become more vulnerable to²². In stark contrast with all other electricity generators, the waste products from nuclear power plants have been managed in an effective and responsible way for decades, with the first high-level waste repository nearing completion in Finland. While most other electricity generators have very large environmental footprints, the nuclear industry continues to deliver clean and affordable electricity in a responsible manner around the world.

The recent heatwave, bushfires and accompanying black-outs are an ominous reminder of the pressing need to decarbonize, while maintaining a diverse and resilient energy mix. If Victoria leads in the development of nuclear power plants in Australia, it will enjoy the many opportunities from nuclear power, be it reliable, dispatchable and affordable low-carbon electricity, whereas neighbouring states become increasingly reliant on intermittent renewables and affected by price volatility. Victoria could import power when the inter-state price is cheap and export when it is expensive, much as it does today.

²⁰ Frazer-Nash Consultancy, 2018, [Identifying the role for nuclear power in Australia’s energy transition](#)

²¹ IEA World Energy Outlook, 2018

²² Financial Review, 31 Jan 2020, [SA cut off from national grid as Victorians asked to power down](#)

Nuclear power plants are the perfect low-carbon substitute for coal plants in the mix as they play a similar role in the mix. However, they offer the added advantage of potentially being a direct substitute for them. Many of the physical infrastructure requirements, such as water, grid connection are essentially the same. This means that existing coal plant sites might be a good first choice for hosting nuclear power plants – although there would still need to be detailed evaluations and community support for such a proposal.

By setting up training programmes and centres of excellence Victoria could emerge as the hub of nuclear competency within Australia. If nuclear plants were built and timed to start operating with coal unit closures this would also provide a just transition for many coal power plant workers without the need for a career change or relocation. Nuclear plants and coal plants are both thermal plants and share a need for many of the same specialisations. In fact the Construction, Forestry, Maritime, Mining and Energy Union (CFMEU) submission to this inquiry has just been published where they note that *“A ‘Just Transition’ of coal fired power station workers and their communities towards a modern nuclear industry is realistically achievable, whereas CFMEU M&E Vic believes a ‘Just Transition’ to renewables is not.”*²³

On the basis of the evidence provided, World Nuclear Association would strongly support the repeal of the current ban on uranium mining and nuclear power. We believe such a repeal would provide the State of Victoria with a first-mover advantage within Australia and would create competitive advantages to Victoria in regard to electricity costs, job creation, economic activity and decarbonisation. We provide two attachments to this submission²⁴ which provide more details on why the state should aim to develop nuclear energy.

²³ Construction, Forestry, Maritime, Mining & Energy Union Mining & Energy Division, [Victorian Parliament's Environment & Planning Committee Inquiry into Nuclear Prohibition in Victoria](#)

²⁴ i) World Nuclear Association's [submission](#) to “the inquiry into the prerequisites for nuclear energy in Australia” and ii) World Nuclear Association white paper, 2019, [The Silent Giant: The need for nuclear in a clean energy system](#)