Submission No 27

INQUIRY INTO URANIUM MINING AND NUCLEAR FACILITIES (PROHIBITIONS) REPEAL BILL 2019

Organisation: Australian Nuclear Association

Date Received: 25 September 2019

AUSTRALIAN NUCLEAR ASSOCIATION INC.

PO BOX 472, ENGADINE, NSW 2233, AUSTRALIA

Email: ANA@nuclearaustralia.org.au
Web: www.nuclearaustralia.org.au

Submission to

NSW Legislative Council Standing Committee on State Development

Inquiry into the Uranium Mining and Nuclear Facilities (Prohibitions) Repeal Bill 2019

25 September 2019

Summary

There is no justification for continuing the historic prohibitions of uranium mining and nuclear facilities in NSW. These selective prohibitions are to the detriment of regional communities that could benefit from the jobs and investment in uranium mining and nuclear power and to the broader NSW community who could benefit from increased economic activity.

Nuclear power is widely used in many countries where it provides security of supply as well as reduces carbon emissions and other air pollution.

The International Energy Agency analysed different electricity technologies and found that nuclear power is competitive in terms of the levelised cost of electricity (LCOE) with fossil fuel and renewables. An assumption that the cost of nuclear will be so high as to be uneconomic is no reason to maintain legislative prohibitions.

The Australian Nuclear Association strongly recommends passage of the *Uranium Mining and Nuclear Facilities (Prohibitions) Repeal Bill 2019* to repeal the historic prohibitions against uranium mining and nuclear power.

Repeal of the legislative prohibitions does not imply that nuclear power will necessarily be introduced in NSW. However, it would allow it to be considered on its merits as part of our energy future.

1. AUSTRALIAN NUCLEAR ASSOCIATION

The Australian Nuclear Association is an independent incorporated scientific institution with members from the professions, business, government and universities with an interest in nuclear topics. Many of our members are professional scientists and engineers with considerable experience and expertise in nuclear issues.

2. URANIUM MINING

Although uranium mining is banned in NSW, a previous ban on exploring for uranium was repealed in 2012. Currently it is legal to explore for uranium but illegal to mine uranium if it is found. Mining uranium is legal in South Australia, Western Australia and the Northern Territory.

Removing the prohibition will benefit regional centres by allowing uranium mines to be develop where proposals meet the already stringent mining regulations and licensing processes.

Most of the risks, hazards and environmental impact of uranium mining are similar to those of other mines already regulated and licenced in NSW. A uranium mine would also need to meet NSW radiation safety regulations which apply to the workers at the mine and the public. Radiation regulations needed for mining uranium are very well established and already applied in industries managing radioactive materials and in mines with significant naturally occurring radioactivity. There is considerable experience interstate and overseas on the successful and effective regulation and licensing of uranium mines.

The modern uranium mining industry has a good safety record. Radiation dose records are compiled by major mining companies under the scrutiny of regulatory authorities. Aside from radiation, the occupational health and safety hazards of modern uranium mining are no greater than, nor distinct from, other comparable mining operations.

This selective prohibition of uranium mining is to the detriment of regional communities that could benefit from the jobs and investment in uranium mining and to the broader NSW community who could benefit from the increased economic activity.

The prohibition on uranium mining in NSW should be repealed so that NSW can benefit from the international trade in uranium.

3. NUCLEAR POWER

3.1 Remove Prohibitions to allow Nuclear Facilities to be Considered on their Merits

Nuclear power is a major generator of electricity in most advanced and many developing countries where it is considered an essential part of their electricity supply.

Notwithstanding that nuclear has a very good record overseas in supplying reliable, affordable and low carbon electricity, NSW has historic prohibitions from 1986 that prohibit the construction or operation of nuclear facilities in NSW including a nuclear reactor whether or not designed for the purpose of generating nuclear power. The Act has exceptions for

- construction of a nuclear facility by the Australian Atomic Energy Commission or its successor ANSTO,
- construction and operation of a facility for storage or disposal of radioactive waste from the use of authorised purposes, and
- the operation of nuclear powered vessels.

When the Act was passed in 1986, the HIFAR research reactor was operating at Lucas Heights under the AAEC and since then HIFAR has been replaced by the 20 MW OPAL multipurpose research reactor.

Repealing the prohibition against nuclear facilities would allow proposals for nuclear facilities in NSW including nuclear power plants to be considered on their merits as part Australia's energy system.

Based on the overseas experience, nuclear power would increase electricity supply reliability and affordability as well as reduce carbon emissions. Nuclear power plants in regional locations would be a major long-term employer including many highly skilled jobs. Nuclear could enhance the health and welfare of people in NSW and improve the environment by reducing emissions.

3.2 Nuclear Power is a Mature Technology and Should Not be Prohibited in NSW

Nuclear power is a very well-established technology with over 17,000 nuclear power plant-years of commercial operation since the first commercial nuclear power plants started in the 1950s.

At the end of 2018, there are about 450 nuclear power plants in service in 30 countries and about 55 nuclear power plants under construction [IAEA 2019]. In 2017, nuclear provided 10.2% of the global electricity and about 18% of the electricity of OECD countries. [IEA 2019a]

Nuclear power plants are very reliable operating at a high capacity factor – in 2018 the global average capacity factor was 79.8% [WNA 2019a] - providing dispatchable electricity 24 hours per day. The very low carbon emissions of nuclear power greatly assist these countries in meeting international carbon emission commitments.

Uranium is a very energy dense fuel. This means for example that while a 1000 MWe coal plant would consume about 2.6 million tonnes of coal per year, the equivalent nuclear plant would consume only 25 tonnes of uranium. Partial refuelling of pressurised water reactors takes place every 18 to 24 months.

3.3 Nuclear Generates Low Carbon Clean Electricity

The demand for electric power for private and industrial use, including the transport and developing electric vehicle market will increase. Nuclear energy plays a key role in lowering carbon emissions from the power sector in many countries. The carbon emissions for the whole nuclear fuel cycle are very low and of the order of 40 g CO_2/kWh. This low carbon emission is similar to emissions from wind and hydro per unit of electricity produced [IPCC 2014] and slightly less than solar PV. This comparison assumes that methane from hydro is not significant and ignores the emissions from any storage or backup generators for wind and solar.

In 2018, nuclear power plants around the world produced 50% more clean electricity than wind and solar combined [IEA 2019a]. In the European Union and USA, nuclear produces more low carbon electricity than hydro [IEA 2019b].

The use of nuclear enables countries to achieve low carbon emissions from electricity generation. For example, nuclear supplied 72% of electricity in 2016 in France which had an electrical generation carbon emission intensity of 58 g CO_2/kWh compared to 440 g CO_2/kWh for its neighbour Germany which has a similar sized electricity grid and is closing nuclear plants. [EEA 2019]

Nuclear benefits the environmental by reducing carbon emissions and other air pollution.

Nuclear is a large-scale generator which can be a coal replacement technology. Both large scale nuclear power plants and the emerging small modular reactors (SMRs) would maximise the use of our existing power resources such as the grid, transport systems, cooling resources and

most importantly the existing work forces. The construction and operation of nuclear power plants can help to ensure stable regional communities and local economies for many decades.

3.4 Costs of Nuclear are Competitive

The construction cost of nuclear power plants depends on many factors including the type of plant and the vendor, whether it is first or n-th of a kind and the country where the nuclear power plant is being built.

The International Energy Agency analysed different electricity technologies and found that nuclear power is competitive in terms of the levelised cost of electricity (LCOE) with fossil fuel and renewables. The long potential operating life and low operating costs of nuclear offset the high construction costs [IEA 2015].

However, LCOE analysis does not include system costs in a grid operating with significant variable renewable energy (VRE). Adding a low cost VRE to the grid requires backup generators or storage available for the times when the VRE is not producing electricity. In addition to this, as greater reductions in carbon intensity are made, every element of a VRE grid will be operating at steadily reducing capacity factors. For example, the peaking gas turbine that may operate at 20% capacity factor at 40% VRE may drop to a 5% capacity factor at 75% VRE yet its capital and standby costs still need to be covered.

A recent OECD report on the costs of decarbonisation highlighted the impact of the variability of wind and solar have on electricity system costs and the cost of the extra backup generators, costly transmission lines and excess capacity required [OECD 2019].

The results from the OECD report of the capacity mix model for ERCOT (Electricity Reliability Council of Texas) with and without nuclear energy are shown in Figure 1. This shows more than a sixfold increase in generating capacity when VRE is the sole option compared to options which include nuclear energy. The cost implications for these various ERCOT emissions targets are shown in Figure 2.

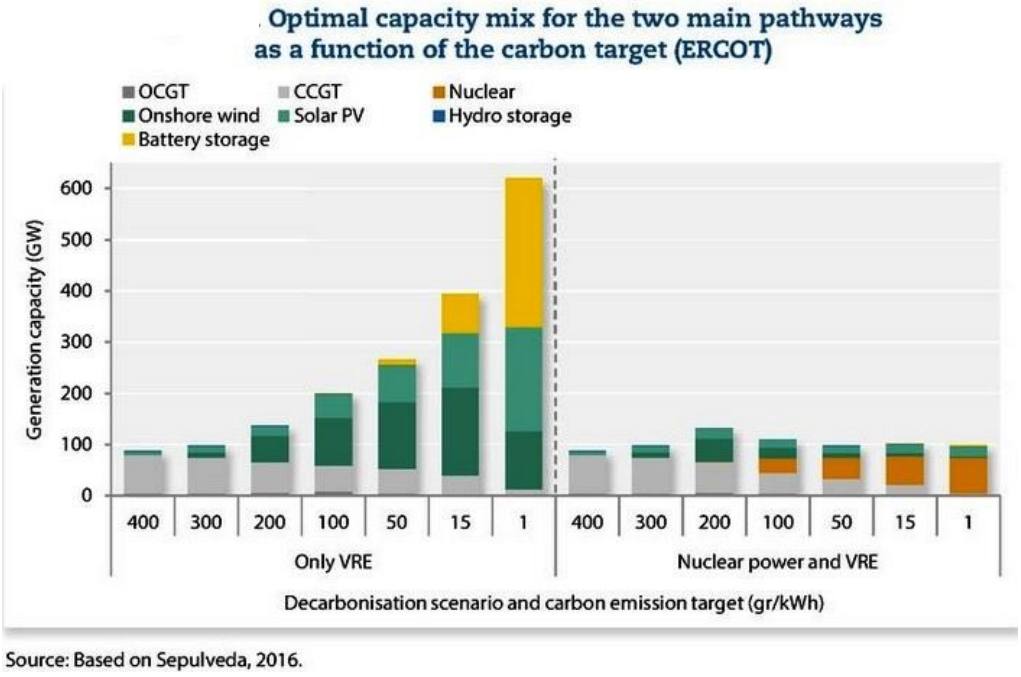

Figure 1 - Impact of capacity mix with and without the inclusion of nuclear energy [OECD 2019, Figure 17].

Decarbonising our electricity system will need an optimum economic mix of low carbon technologies to work together. Because of their intrinsic variability, the overall system cost of adding large amounts of wind and solar are larger than the sum of their individual plant level costs.

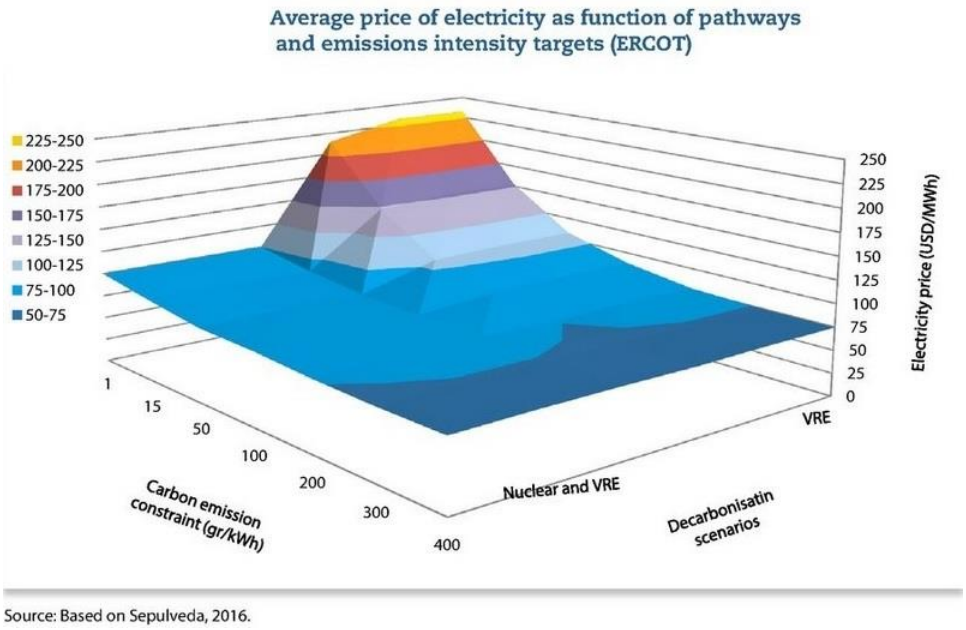

Figure 2 - Average price of electricity as a function of pathways and emissions intensity targets [OECD 2019, Figure 15]

The results of the study carried out on the ERCOT system and highlighted in the OECD 2019 analysis can be translated to many similar jurisdictions including that of New South Wales. The trends observed when comparing a system that excludes nuclear energy with one that includes nuclear provide valuable insights.

In particular, the OECD 2019 study concludes that:

"… diversity of energy sources drives down total costs of energy in a low-carbon system, whereas taking options off the table – such as nuclear – creates extra costs to society".

It also indicates that:

"… the impacts of decarbonisation targets on the optimal investment policies are not linear and some targets may yield a share of a particular technology e.g. wind, that under a more stringent target may not be present in the optimal mix".

It is therefore important that decarbonisation policies are not based on pre-specified shares of low-carbon resources in the mix, but rather on CO_2 reduction goals [OECD 2019].

For any modelling or policy development in Australia it is vital that nuclear energy be included in the options. To enable such modelling to proceed it is essential that more thorough collaborative cost analyses be carried out directly with reliable vendors who have established track records in successful project implementation.

The time to build a nuclear power plant has a major bearing its cost. Although recent construction of some first-of-a-kind power plants in Finland, France and the USA have cost

more than planned, the overall conclusion of the International Energy Agency study stands - in most countries nuclear is economically competitive as a generator of electricity.

The construction times of the EPR and AP1000 nuclear power plants already built and operating in China were much shorter and at lower cost than the first-of-a-kind nuclear power plants of same design built in Europe and the USA.

The median construction time for nuclear power plants completed between 2011 and 2017 was 68 months from first pouring of concrete to the connection of the unit to the grid [IAEA 2019].

The experience of the United Arab Emirates (UAE) demonstrates that large nuclear plants can be built and operating about 10 years after the decision to go nuclear. The UAE was a country with no nuclear power when it decided in 2008 to introduce nuclear power. The UAE selected a bid from a Korean Electric Power Company (KEPCO)-led consortium in December 2009 for the supply of four Korean-designed APR1400 nuclear power plants at Barakah in the UAE. The first of these four 1400 MWe plants was completed nine years later in 2018. Only training and administrative matters have delayed its grid connection until 2020 with the last plant to be connected in 2023 [WNA 2019b].

The costs of constructing nuclear plant in Australia will really only be known when vendors make proposals for 1000 MWe plants or SMRs destined for Australia.

It is important that the legislative prohibitions be removed so that nuclear can be properly assessed. An assumption that the cost of nuclear will be so high as to be uneconomic is no reason to maintain legislative prohibitions.

3.5 Safety

The Chernobyl accident is the only accident in the history of nuclear power generation in which deaths have occurred from radiation. It is important to note that the Chernobyl nuclear power plant type would not have been licenced outside the former Soviet Union.

With regard to Fukushima there is no clear evidence of any deaths attributable to the emission of radiation from the three meltdowns that occurred and radiation doses to the public were ten times lower than the dose at which any direct health impacts become evident.

As with the aircraft industry nuclear power plant designs are continually being improved based on the operating experience of current nuclear power plants. The most significant design improvements in both large scale Generation III and SMRs is the introduction of safety features which enable these reactors to automatically shut down and remove decay heat using passive controls. This means that the reactors remain safe without external power supply or human intervention for an extended time.

SMRs power plants based on factory-built modules rated from 10 MWe to 250 MWe are now undergoing regulatory assessment overseas. SMRs have advanced safety features, are designed to load-follow and their modularity reduces the upfront capital cost making them easier to finance and quicker to operate.

Nuclear power plant designs are assessed, approved and licensed by a nuclear regulator before construction. ARPANSA has for many years ably performed its role as Australia’s federal nuclear regulator. With more resources and by drawing on international experience in regulating and licensing nuclear power reactors, ARPANSA can apply its experience and knowledge to also regulator nuclear power reactors.

3.6 Nuclear Power – A Realistic Option for Australia

Nuclear could make a significant contribution to the reliability of Australia's electricity grid and reduce carbon emissions. Historically, nuclear was not needed when Australia could rely on its extensive reserves of low-cost coal.

Australia can benefit from current and emerging nuclear power plant designs as well as from the considerable international experience accumulated in regulating nuclear power nuclear power plants, taking into account safety, environmental, technical, economic and social factors.

Australia is increasingly faced with power prices that are destroying the competitiveness of our manufacturing sector. Together with the urgent need to meet international carbon emission commitments, nuclear is a real option to be part of Australia's energy future and make a very significant contribution to improving energy cost and reliability and lowering carbon emissions of Australia's power system.

Vendors cannot consider proposals for using nuclear in Australia nor collaborate in realistic costings when the technology itself is prohibited. Now is the time to remove the NSW prohibitions to allow nuclear to be considered on its merits.

The nuclear prohibitions must be removed to allow nuclear to be considered on its merits as part of Australia's energy future.

4. RECOMMENDATION

The Australian Nuclear Association strongly recommends passage of the *Uranium Mining and Nuclear Facilities (Prohibitions) Repeal Bill 2019* to repeal the historic prohibitions against uranium mining and nuclear power.

References

EEA 2019. *CO_2 Emission Intensity Electricity Generation.* European Environment Agency.

IAEA 2019. *Nuclear Power Reactors in the World.* International Atomic Energy Agency, Vienna, May 2019

IEA 2015. *Projected Costs of Generating Electricity*, International Energy Agency, Nuclear Energy Agency, Organisation for Economic Co-operation and Development Sept 2015

IEA 2019a. *Electricity Information Overview*, International Energy Agency 2019

IEA 2019b *Nuclear Power in a Clean Energy System*, International Energy Agency May 2019

IPCC 2014: *Emissions of selected electricity supply technologies (gCO2eq/kWh)*. Table A.III.2, Annex III: Technology-specific cost and performance parameters. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

OECD 2019. *The Costs of Decarbonisation: System Costs with High Shares of Nuclear and Renewables*, Nuclear Energy Agency, Organisation for Economic Co-operation and Development, OECD June 2019 NEA No 7299.

WNA 2019a. *World Nuclear Performance Report 2018.* World Nuclear Association

WNA 2019b. United Arab Emirates country profile. World Nuclear Association