Committee Secretary
Senate Standing Committees on Environment
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Submission on repeal of nuclear prohibitions

I am a retired former white collar worker who has lived in NSW, ACT, SA and Tasmania. I got my first solar installation in 2005 and I am about to get a third installation with battery. I have years of experience in self sufficiency ranging from food growing and making biodiesel from waste cooking oil to helping neighbours with microhydro. I have experimented with biogas which I found to be impractical and green hydrogen which is grossly inefficient in terms of energy lost. I now see that some much hyped replacement technologies for fossil fuels will not be adequate.

The need for concentrated power on demand

The enormous economic and population growth of the last century has been on the back of the dense energy sources coal, oil, gas, nuclear and hydro. All have issues in terms of waste products or looming scarcity. Many now hope we can replace these sources with wind, solar, energy storage, extra connection and demand management. However this introduces problems of intermittency, cost, intrusive infrastructure, electric signal stability and rationing. These factors have been downplayed by supporters but are becoming increasingly evident.

Despite two decades since the 2001 MRET Australia still routinely requires 10 GW of coal fired baseload out of a recurring 20-30 GW electricity demand. Therefore scenarios which have renewables penetration at over 80% within a decade should be viewed with some scepticism. No advanced country without exceptional hydro has yet gone all renewable. New nuclear holds out the promise of a return to the halcyon days of the old economy but without the emissions.

Drawbacks of high penetration wind and solar

Increasing Australia's solar and wind capacity fourfold may eventually be able to replicate recent electricity output. In 2021 that was 266 TWh of which 73% was from burning fossil fuel. That is less than the estimated 300-400 TWh of carbon free electricity generated by Australian uranium in other countries. However the timing of clean generation is as critical as the amount. Geographically widespread wind lulls and overcast weather can last for days but the economy must go on 24/7. The difficulty is balancing erratic supply without expensive and emitting gas backup. Short and long term energy storage will cost many billions. On a daily basis chemical batteries such as lithium ion can help but are expensive to operate and replace every few years. Some say there may not be enough lithium to meet projected demand. Multi-day storage such as pumped hydro has huge capital costs and long lead times. Another requirement for high renewables will be thousands of kilometres of costly new transmission.. above ground, below ground and on the sea bed.

Demand management will impose more costs as well as equity issues. Industries such as smelting will get generous compensation to cut energy use when required. Households may be routinely requested to make voluntary cuts such as reducing air conditioning in heatwaves. If that doesn't work plans are in place to reduce air conditioning by remote control. Recently the US and Switzerland requested drivers to refrain from EV charging. Apart from resenting authoritarian measures low income households will struggle with the cost of living. Unreliable or expensive energy may cause some unsubsidised industries to leave Australia or prevent value adding

industries from emerging. Energy constraints may force Australia to import even more finished goods made with its own raw materials, current examples being steel, rare earth metals, aluminium, titanium and battery ready lithium.

Future energy demand

In Australia in 2021 about 30% of domestic primary energy supply came from natural gas (which is mainly methane) an enormous task to replace with wind and solar electricity. Electric appliances are mooted to replace most gas appliances for heating and cooking. This is desirable for reasons of depleting southern gas basins, long term cost saving and emissions reduction. However electrolytic (green) hydrogen is not a credible replacement for natural gas for most applications. Impediments include the per unit cost and the need for huge new infrastructure and retooling. Green steel via hydrogen will take 20% of a nations electricity. The exception may be using green hydrogen to make ammonia input to fertilisers such as urea, essential for food production.

A projected 10 million EVs requiring daily charging might require a 10-15% increase in electricity production. The inevitable El Nino years will require a number of desalination plants to be activated. On top of that Australia has one of the highest population growth rates among OECD countries. That will overwhelm any efficiency gains. Australia will need a lot more primary energy but the present path appears doomed to require belt tightening.

Australia already has key resources

Despite world leading uranium reserves local enrichment is probably not economic though the Australian developed SILEX laser process is now employed in the US. Australia's recent annual yellowcake production including the closed Ranger mine was about 6,000 tonnes. Estimates differ but that could generate at least 300 TWh in other countries saving perhaps 300 Mt of global CO2 if it mostly displaces black coal. Note that overseas carbon free generation from our uranium is more than Australia's combined output from both carbon and non-carbon sources.

Uranium comes out of holes in the ground in the outback so local spent fuel (perhaps to be reprocessed years later) could go back there. Suitable long term waste sites such as depleted mines already exist. Waste storage is not a logistically difficult issue but seems to be an *idée fixe* for opponents. You would also expect some useful knowledge exchange when Australia acquires US or UK built nuclear submarines.

Australia and SMRs

Several models of small modular nuclear reactor (SMR) should be available to Australia by 2030. Leading engineering firms are aiming at an electricity production cost of around $US60 per MWh. In contrast gas fired generation our electricity of last resort in the NEM is typically over $A150 per MWh. Since SMRs are heavily prefabricated installation time after experience could be as little as 3 years. Some models will not be just steady baseload but can partially load follow indefinitely in the manner of gas and hydro and unlike short term batteries. SMRs could be located at former coal station sites like Playford SA, Hazelwood Vic and Liddell NSW. No new transmission lines would then be required and the cooling facilities (lakes, seawater, towers), switchyards and suitable local staff could all be re-employed.

Australia should establish a dialogue with leading SMR developers such as Rolls Royce, General Electric-Hitachi, NuScale, Westinghouse-Toshiba, Kepco, Framatome, Mitsubishi, Holtec and so on. I believe all of their immediately proposed SMR technologies are of the light water coolant type, similar to submarines in the West. Other nuclear technologies such as molten salt thorium, pebble bed gas cooled, travelling wave and fast neutron 'waste burners' will not be available in the West for many years. I note Rolls Royce has Australia down for 2000 MW of sales in their forward marketing plans which would be some 5 of their units.

Noncommittal discussions with manufacturers could cover site suitability and fuel needs with ANSTO as the negotiating authority. Small nuclear should aim to replace all that 10 GW coal baseload dependence as well as sidelining most of the backup gas plant. That might require some 20 or so half gigawatt sized SMR units. Fewer sites than that would be required as some would house multiple units.

A complication may be what I perceive is the anti-nuclear bias of AEMO. That organisation has given exorbitant cost estimates for SMRs yet failed to predict recent developments such as massive price increases in the existing energy market. Another issue for Australian nuclear is the NEM bidding system which favours supposedly cheap intermittent generation but ignores major flow on costs. Added imposts for backup, round trip inefficiency, frequency correction, subsidies and new transmission don't figure in the bidding system. Moreover unlike going AWOL in the military there is no penalty for being absent when most needed e,g. solar at night and wind in heatwaves. Nuclear is generally always on except for refuelling every few years so should have some must-take priority, perhaps via a pricing model akin to the UK.

I therefore urge the Committee to recommend the repeal of legislation which prohibits commercial nuclear power in Australia. Public acceptance of nuclear submarine plans has been surprising now perhaps the public could consider a dozen SMR installations around Australia. In the interim Australia could find itself in a position in which energy supply is glaringly not fit for purpose, not low carbon nor affordable. All options should be kept open.

Yours sincerely

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