

Submission to the Inquiry into Nuclear Prohibition (26/2/2020)

Context

This submission is not intended to represent the perspectives of any of the companies or organisations that I am or have been employed by or affiliated with. This is an individual submission based on 20 years of professional experience in fields relevant to the terms of reference of the Inquiry.

I am a nuclear physicist and have worked in the energy industry for several years in the field of Energy Risk Management. This work has included modelling financial risks for generator-retailers operating in Australia's National Electricity Market (**NEM**). The energy portfolios I have worked with have included residential, commercial and industrial electricity demand and renewable generation in multiple states, including in Victoria. I have significant first-hand experience with the challenges and opportunities presented by the energy transition (and the process of decarbonisation) which is currently underway in the NEM.

Prior to moving into the energy industry I specialised in the field of radiation protection, working at a number of uranium exploration and mine sites in Australia and internationally. In 2002 I joined the Radiation Protection Division of the South Australian Environment Protection Authority. This agency is responsible for radiation protection in medical, industrial and mining contexts, including the regulation of uranium exploration, mining, processing and transport, while The Australian Safeguards and Non-proliferation Office (**ASNO**) is responsible for Non-proliferation in relation to Australia's uranium exports.

Through my own experience working as a regulator and later as a consultant in the field of radiation protection I have a great deal of confidence that Victoria can become a leader in building Australia's nuclear industry from where it is now to a level of excellence which compares to Finland, Sweden, France or the UK (for example), only it has been planned and designed with the benefit of decades of international nuclear industry experience. I am confident that Victoria can develop the capability to operate and regulate nuclear facilities including a nuclear fuel recycling facility, nuclear power plants, cutting-edge nuclear medicine facilities and materials science research facilities which place the next generation of Australian scientists and engineers in Victoria at the forefront of science and technology internationally. Victoria can place itself in a strong position for the future that lies ahead.

1. Uranium Mining – Potential for Victoria to contribute to global low carbon dioxide energy production through enabling exploration and production of uranium and thorium;

Uranium export is by far the most efficient form of international energy export, and as other countries seek to move away from fossil fuel usage, nuclear power will offer them a net zero, non-intermittent alternative to coal and gas. A kilogram of uranium has over 2 million times the energy content of a kilogram of coal. Instead of the thousands of ships of coal and gas that are currently

sent to Asia annually, when coal and gas are phased out in the next few decades this plausibly could be a just a few uranium fuel shipments delivering just as much or more in equivalent energy. This is a more sustainable approach to energy export than what is presently occurring and from a stewardship perspective is far better than exporting fossil fuels which contribute significantly to global carbon dioxide emissions.

Australia has a long and successful history of uranium mining and a high level of expertise in this area including extensive radiation protection expertise located within Victoria due to the presence of the Australian Radiation Protection and Nuclear Safety Agency (**ARPANSA**) and a number of other organisations and mining companies which are already involved in uranium exploration, mining, processing and export.

If uranium mining is permitted in Victoria this will be beneficial as a new source of royalties and employment, but it will also help Victoria do its part in helping to reduce global CO₂ emissions by supporting a form of electricity generation which does not burn fossil fuels. As at 2020, hydro and nuclear are the only proven emissions free technologies (globally), which enable economic firming of renewable energy at scale.

2. Nuclear Technologies – economic, environmental and social benefits for Victoria, including those related to medicine, scientific research, exploration and mining;

Without exception, technologically advanced countries (including Australia) use nuclear technologies extensively to provide access to advanced nuclear medicine (this provides in many cases the most effective diagnostics and treatments, i.e. the best possible medical care). While at present Australia's main focal point of nuclear research and science is in New South Wales (in connection with ANSTO's Opal research reactor located at Lucas Heights), Victoria could also host advanced facilities (i.e. in addition to the Australian Synchrotron, an advanced accelerator facility which is hosted in Melbourne).

3. Opportunities to participate in the Nuclear Fuel Cycle

There are several opportunities for Victoria to participate in the Nuclear Fuel Cycle, including:

- a) Zero carbon emissions electricity production (nuclear power generation)
- b) Recycling of nuclear fuel, extraction of valuable elements and long-term storage of spent fuel elements which are not economic to extract. [Note: It is possible to extract any element and there are numerous widely used industrial applications for radioactive elements, hence it is a matter of economics as to which elements are cost effective to extract. For example, in France, Orano recycle and reuse 96% of spent fuel materials]
- c) Enrichment of uranium and fuel fabrication
- d) Exploration and mining of uranium
- e) Research and development of generation technologies, fuels and site-specific applications (e.g. zero emissions generation for remote mine sites and remote towns using smaller reactors)

Of all the opportunities the one that stands out for Victoria in particular is the potential to replace the existing high emissions brown coal plants with a zero emissions generation mix. France has the cheapest, most reliable and lowest emissions generation mix in Europe because France has a high proportion of nuclear power, as do Finland and Sweden.

4. Barriers to participation, including limitations caused by federal or local laws and regulations.

Barriers to participation include out-dated anti-nuclear clauses in the EPBC Act which should now be removed. The most serious “matter of national environmental significance” in Australia is climate change and it is largely being caused by the ongoing burning of fossil fuels, including in Victoria. Hence if there are any electricity generation types which could justifiably be banned via legislation at some stage in Australia, they are coal, gas and diesel. The ongoing burning of these fossil fuels globally presents a credible and likely threat to the environment.

The ideal approach in designing Victoria’s nuclear industry would be to adopt the principles of a sustainable circular economy. In this case, for example, spent fuel from nuclear power plants is recycled in a similar way to that successfully achieved at Orano la Hague in France where 96% of material is reused in the nuclear fuel cycle. For Victoria to become a technologically advanced state in this way it means that all anti-nuclear clauses within legislation must be removed, so that all aspects of the fuel cycle can be included in a complementary and consistent way.

It is also advisable that Victoria adopts a technology neutral stance on reducing emissions in the electricity sector. This means in practice not relying solely on an approach like a renewable energy certificate, which effectively only rewards emissions reductions (i.e. only values the integrity of the atmosphere) at times when it is sunny or windy (at all other times the electricity market is blind to emissions and therefore does not protect the atmosphere or encourage the dispatch of low or zero emissions sources of energy). The current market settings encourage the use of more gas and the construction of more gas-fired generators to be used when VRE sources are low (and indeed fossil fuels to be used to provide grid services such as Frequency Control Ancillary Services).

If a low (or zero) emissions electricity generation mix is sought, in accordance with a 2050 net zero target, then Australia nationally (or at the very least the states individually) should legislate either an emissions intensity scheme, a price on carbon or a low emissions generation certificate scheme (e.g. a Clean Energy Target), rather than just a Renewable Energy Target. If emissions are not explicitly included in the electricity market design, then fundamentally we do not value the atmosphere appropriately.

The atmospheric CO₂ concentration is now in excess of 410 ppm and continues to increase each year. Wind and solar alone cannot replace coal due to their intermittency. Nuclear would be a great solution to enable the decarbonisation of Victoria’s electricity supply as we approach the 2050 net zero target or in advance of it.

Fear of nuclear technology is a sensitive topic, but it is increasingly apparent that this reactionary type of fear is itself far more dangerous and limiting than the nuclear fuel cycle will ever be. To be specific, the probability that a person now living in Victoria will be in any way harmed by nuclear

technology in the decades to come is so small as to be approximately zero and it remains approximately zero whether Victoria hosts nuclear reactors, reprocessing facilities and spent fuel storage, or not. Indeed, whether a person resides in Victoria, in Lucas Heights, New South Wales or in France the risk that the person will be harmed by radiation from a nuclear reactor or from the nuclear fuel cycle remains so small as to be approximately zero. Conversely, the risk that someone who lives in Victoria will be impacted significantly by climate change in their lifetime is so high as to be close to 100%. Furthermore, the risk that fragile ecosystems in Australia and marine ecosystems off the coast of Australia, will be impacted negatively by climate change is so high as to be approximately 100%.

Other than nuclear energy, we are faced with very limited options for providing economic, carbon neutral, non-intermittent electricity generation (i.e. to replace coal and gas).

Community support is essential for any project, but it would be irresponsible to pander to individual reactionaries who are not psychologically inclined to put the health and safety of the environment first (they may well choose to remain anti-nuclear at all costs, even when the impacts of climate change become physically dire for ecosystems and for people). Indulging and accommodating anti-nuclear emotional reactions (or indeed climate change denial) can't be justified any longer by responsible governments.

In South Eastern Australia we face accelerating climate trends. We need to promote and support every realistic means of carbon neutral electricity generation that is currently available, including nuclear power and to action this as soon as possible. This will put us on a credible path to net zero by 2050 and most importantly it will enable us to become leaders and influencers internationally.