Inquiry into the Prerequisites for Nuclear Energy in Australia

Submission by Bernd Felsche
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Overview

This submission focuses on the prerequisites for nuclear energy in Australia:

- Replacing the ban on nuclear technologies with legislation that provides certainty to potential investors.
- Public education about nuclear power and radiation to address irrational fears. Education is necessary to provide information on how the industry manages the risks.
- Economic factors such as feasibility and affordability are best assessed by potential investors as they have an enduring interest in the success of their investment. Feasibility is immutably dependent on affordability in a free market.
- Health and safety concerns must be considered in the same manner as other industry that manages similar energy densities (outside of the reactor) and hazardous materials.
- Environmental considerations must take into account the vastly smaller quantities of materials, and area than other generating technologies of equal generating capacity.
- Tertiary Education must support Nuclear Engineering and associated studies for a sustainable workforce capability.
- Latent capabilities of existing immigrants with qualifications and experience can be activated via employment opportunities. Work visas for short-term and future, skilled immigration have to be adapted to support industry requirements.
- Import and export regulations must be adapted so that related equipment and materials can be traded commercially in a safe and secure manner, without introducing barriers that add unnecessary costs.

The above will be discussed in detail on the following pages. Each of the sections is cross-referenced to the relevant points listed in the Terms of Reference of this Inquiry. (Attached in Appendix A.)

About the Author

Bernd Felsche is a Mechanical Engineer with a Bachelor of Engineering from the University of Western Australia, graduating in 1983. The author has diverse interests including nuclear power generating technologies.

About Electrical Power

Electricity is a means of transmitting energy from one location to another. Electrical power is a mechanism between where the electrical power is generated by conversion from an energy carrier; to the power consumer where it is converted to e.g. mechanical effort or heating.

Generation of power must therefore occur at the time of consumption in the exact quantity required by the consumer. There exists no practical means of “storage” beyond the fraction of a second. Storage for longer periods requires conversion to a stable energetic means (potential energy) and recovery by conversion from storage; a reversal of the storage process. Neither storage nor recovery are 100% efficient.

Discussion

1. Laws and Regulation

(Terms of Reference items e. and j.)

The existing blanket ban on nuclear technologies in Australia must be lifted as a prerequisite to any other legislation that would enable nuclear power generation and associated industries.

A credible coherent policy must be determined as a framework for future legislation to govern the industry in the long term. Such a policy is essential to engage the interest of domestic and foreign investors that are essential for a successful industry.

Legislation must assure potential investors that, in the event of a future reversal of policy, that they will be compensated for their losses in the same manner as are others whose property is acquired by the Commonwealth.

Compliance with regulations must be on a technical basis with measurable parameters and verifiable, physical evidence.

States' legislation should be in accord if the States are to host a nuclear industry.

2. Public Education

(Terms of Reference items f., i. and j.)

As the target of mass media sensationalism and activist scare campaigns, the public deserves a balanced education regarding nuclear technologies. An education that presents how the risks are managed by technology and processes in an industry that globally has the lowest mortality rates of all power generating technologies.

A sense of proportion must be encouraged especially with regard to radiation from natural sources of radiation and levels of background radiation historically known to not be harmful to humans.

3. Economic Factors

(Terms of Reference items d. and e.)

The feasibility of nuclear power is predominately a commercial consideration to be made by those who are investing in it. It is imperative that industry regulation does not *de facto* prohibit industry through costly compliance requirements.

Australia will continue to have a growing hunger for electrical power. Affordability will have a degree of influence on the rate of growth. Growth driven by the adoption of more technologies in industry, commerce and the home.

Electrical power consumption is becoming less discretionary in proportion to total power consumption. Reliability becomes an economic factor in a modern, technological society such as Australia's.

It should be noted that the availability of reliable, affordable electrical power encourages further consumption; consumption driven by adoption of more technologies that improve efficiencies and, notionally, the quality of life.

4. Health and Safety

(Terms of Reference item b.)

It's been observed that mental health issues relating to fears about radiation, both in public and in government, can produce more casualties than radiation itself. In the years following the Tsunami that disabled the Fukushima nuclear power plant, there were more than a thousand suicides resulting directly or indirectly from fears of radiation. There were no fatalities due to radiation at Fukushima.

Public education can reduce such tragic consequences by arming individuals a sense of proportion to keep irrational fears at bay.

Health and safety considerations within the nuclear power and associated industries need not differ substantially from those in other industries managing similar energy densities outside of the reactor and hazardous materials; radioactive and otherwise. Differences will arise because of the need to avoid critical mass, while the volume of fuel materials required for regular operation are orders of magnitude less than for e.g. coal-fired power generation. Mechanical hazards from materials handling are proportionately less.

A 1 GWe (gigawatt-electrical) nuclear power plant has an annual fuel requirement that can be delivered by a single truck. The spent fuel volume is the same. The infrastructure to support this is insignificant compared to that by operational staff.

5. Environmental

(Terms of Reference items c. and h.)

The environmental footprint of nuclear power is of much smaller scale than that of technologies capable of providing a similar quality of electrical power.

The volume of materials in construction is comparable to that of some other generating technologies. That doesn't include transport infrastructure as that is highly variable, depending on where the primary energy source is located and how much has to be transported for conversion to electrical power.

The areal requirements for nuclear power is substantially less compared to other power sources when taking into account the areas to be mined or required to collect energy from diffuse sources such as wind and solar. A million times less in some cases when one allows for availability and reliability.

Similarly, transport requirements for fuelling and removal of spent fuel are of small volume and can be easily controlled in secure containers.

6. Tertiary and Trade Education

(Terms of Reference item g.)

As a consequence of decades-long ban, practising Nuclear Engineers are thin on the ground in Australia. Engineers in related disciplines may be engaged during technical evaluation, planning, construction and operations. And much later; decommissioning. There are nevertheless aspects of nuclear power that need a specialised perspective, constructed by education and experience.

Those who wish to practice nuclear engineering in Australia should be encouraged to pursue practical experience in nuclear power plants; overseas until such opportunities are developed in Australia.

A nuclear industry requires not only other Engineers but also technicians for construction and maintenance. Electrical and other trades will require training to the industry as they would to other industries such as oil and gas.

It would be more than inconvenient to have built a nuclear power plant but to be unable to put it into operation for the lack of operational staff.

7. Immigration

(Terms of Reference item g.)

Some immediate demand for nuclear engineering expertise will probably have to be satisfied by skilled immigration or work-visas for short-term demand during construction of plant.

Latent capabilities and qualifications of immigrants already resident in Australia may not become apparent until employment opportunities are created and advertised. The requirements for initial immigration intake and education of Engineers and other special technicians may be thus eased.

Similar repatriation of Australians, educated as Nuclear Engineers and engaged in the industry overseas could be attracted back to Australia by suitable opportunities.

8. Imports and Exports

(Terms of Reference items h. and j.)

It is expected that the first nuclear power plants will be substantially constructed with imported content of specialised equipment. Similarly, at least initial fuelling would be by imported elements.

The return of spent fuel elements to re-processing overseas must be considered in trade.

Domestic fuels production and reprocessing of spent fuels is not estimated to be justified by the needs of even half a dozen domestic nuclear power plants that Australia could plausibly host in the first half of this century.

If such an industry were to be enabled, it would be to also support foreign nuclear power plants. Engaging Australia in the full fuel cycle, supplying reactors with fuel and reprocessing spent fuel presents potential for export trade which should not be denied by a blanket ban such as the one currently in place.

It may indeed benefit the control of nuclear proliferation with Australia “in the loop” of the full fuel cycle from the ores to the fuel elements and their subsequent reprocessing.

9. Uncategorised

(Terms of Reference items h. and j.)

The existing ban on nuclear technologies in Australia has had an impact on national security in the choice of Australia’s future submarines. Submarines designed in France to be nuclear powered, but needing to be adapted for Australia, because of the ban.

This not only compromises defence capability but also impacts taxpayers having to fund a re-engineering of the submarine’s propulsion and power systems.

Appendix A – Terms of Reference

The Australian Government supports an energy system which delivers affordable and reliable energy to consumers while fulfilling Australia's international emissions reduction obligations.

Successive Labor and Coalition governments have maintained a bipartisan moratorium on nuclear electricity generation in Australia. Australia's bipartisan moratorium on nuclear energy will remain in place.

Australia's energy systems are changing with new technologies, changing consumer demand patterns and changes in demand load from major industries. At the same time the National Electricity Market is seeing a significant increase in capacity in intermittent low emissions generation technologies.

Terms of Reference

The Committee specifically inquire into and report on the circumstances and prerequisites necessary for any future government's consideration of nuclear energy generation including small modular reactor technologies in Australia, including:

a. waste management, transport and storage,

b. health and safety,

c. environmental impacts,

d. energy affordability and reliability,

e. economic feasibility,

f. community engagement,

g. workforce capability,

h. security implications,

i. national consensus, and

j. any other relevant matter.

The inquiry will have regard to previous inquiries into the nuclear fuel cycle including the South Australian Nuclear Fuel Cycle Royal Commission 2016 commissioned by the Labor Government in South Australia and the 2006 Switkowski nuclear energy review.