SUBMISSION TO Environment and Other Legislation Amendment (Removing Nuclear Energy Prohibitions) Bill 2022

About the Submitter

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He led feasibility studies for projects around the world, many for battery metals, leading to his detailed examination of the feasibility of energy technologies, especially remote and off-grid projects.

Ross is an experienced company Director with skills in strategy development, and corporate governance and realistic ESG initiatives. He is Director of Business Development – Australia for StarCore Nuclear which is currently in Vendor Design Review with the Canadian Nuclear Safety Commission.

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Introduction

The Bills that banned the use of nuclear power in Australia in November 1998 cannot be considered by any means to have been enacted democratically with only 10 Senators present in the Senate out of the total of 76, and with only 3 voting on the Bill.

Nuclear power has been shown to be the cleanest, most safe and the cheapest source of providing electricity available to the world today.

Unfortunately, nuclear power can be described as having an image problem. There is widespread general ignorance of the facts and successful protestation by those with varying motivations that has hindered informed public policy debate and excluded nuclear power from our mix of electricity sources. Media coverage of anti-nuclear rhetoric includes regular reportage of inaccurate, misleading and sometimes untruthful statements that emanate from both government and external parties. Confusion between nuclear energy and nuclear weapons is also abundant.

If we genuinely want to decarbonise our energy system and lead with action in our efforts to address human causes of climate change, as well as provide electricity that minimises the disturbance to nature, then only by including nuclear power in Australia's energy mix can we mitigate and overcome the challenges ahead of us.

Externalities Related to Energy Sources

Proponents of what are known as 'renewable' electricity sources, namely wind and solar, ignore a number of externalities when comparing whole of system costs for energy sources. These include:

- ***Land area***. There is a huge difference in the energy density of wind and solar compared to nuclear. This is seen in the spatial footprint that is needed for each source. Considering just the land for the electricity generating source - and it is important to consider facilities generating the *same electricity output* - solar PV requires around 400 times the amount land to generate the same electricity output as a nuclear power station. This does not include the area cleared for transmission lines to take the electricity to where it will be used. How much nature will we destroy to have 'green' energy?
- ***Capacity factors***. Capacity factors are often quoted in the literature. In practise, the capacity factors are equivalent to availability, which for Variable Renewable Energy (VRE) sources is in the region of 24% for solar and 34% for wind. For nuclear power it is more like 92-94%, thus supplying more power more reliably than VREs.
- ***Quantities of materials of construction.*** Solar and wind facilities require 2 - 5 times more materials of construction than a nuclear power plant producing *the same electricity output*. Those materials include steel, concrete, glass, aluminium and critical metals such as rare earth elements all of which emit considerable quantities of carbon dioxide (CO_2) in their manufacture.
- ***The asset life of the facility.*** Wind and solar farms are considered to need replacing every 20 years. Recent data indicates that the asset life of wind farms is much lower – more like 9 years. Nuclear power plants are typically licenced for 40 years initially and are increasingly having their operating licenses extended to 60 and some to 80 years.
- ***Energy Returned on (Energy) Invested (EROI)***. This measure was developed at Stanford University for the Global Climate and Energy Project that ran from 2002 – 2019. The figure for photovoltaic (PV) solar is around 4 times whereas the EROI for nuclear power is 75 times. It does not make any sense that we want to replace something with an EROI of 35 (coal) with something with an EROI of 4. It is the equivalent of going back to before the industrial revolution.
- ***National security***. Australia relies to a large extent for its national income on its exports of minerals which in turn require diesel for their operations, almost all of which is now imported from Singapore and Malaysia. With only days of reserve, any disruption in the Straits of Malacca would severely disrupt that national income stream. Similarly, around 95% of the world's PV panels come from China. Any disruption in that supply chain would in turn severely disrupt any 'green' energy transition. As one of the largest suppliers of uranium to the world, it is hypocritical that Australia accepts money for it but does not allow its use in nuclear power itself. Excluding the use of uranium in our own country endangers our own national energy security and therefore our economic security.
- ***End of life considerations.*** This is always included in nuclear costings. Wind and solar have no such proposal or plan. New generation nuclear has been developed and is on the table. It possesses the ability to reduce and recycle nuclear waste products. Some proposals do not require any use of water. The small amounts of spent fuel remaining after reprocessing can be safely stored. The low levels of nuclear literacy within government and the Australian public, including waste, recycling, and storage methods, are holding us back from fully engaging with nuclear power as a safe yet powerful addition to our energy mix

Those in favour of utilising only wind and solar for our energy supply are ignoring these externalities. The whole of system cost needs to be considered, including the total economic cost to society, the cost to our land and to our nature and the cost of national security. All of which are borne by our entire society and not simply by the electricity provider.

Sharing his thesis conclusions with Engineers Australia in August 2022, University of Queensland PhD student Gabriel Rioseco's modelling of the east coast grid showed that the VRE integration costs associated with the VRE curtailment, storage and transmission expansion increases much more drastically for the case that doesn't allow nuclear Small Modular Reactors (SMR), versus the case that does allow it. Thus, deploying nuclear SMR contributes to reduce, or avoid the costs of integrating large shares of VRE in the system. The case that does not allow nuclear SMR in the mix presents higher cost across all categories. His conclusions were clear: (The emphasis is Mr Rioseco's)

1. How we model the National Electricity Market (NEM) is **crucial to see the total system costs** and not overlook (some of) them;
2. If we try to decarbonise only with renewables and storage, **total system costs will become very high**;
3. Allowing SMR nuclear in the mix **dramatically reduces the costs of a fully decarbonised system**.

StarCore Nuclear is developing SMRs in Canada designed specifically for remote and off grid sites. Australia has many sites that would fit this specification, such as mining operations and remote communities. The High Temperature Gas Reactors (HTGRs) intended are considered by the International Atomic Energy Agency (IAEA) in their Tech Doc 1674, to be inherently safe. That is, they need no mechanical, human or computer intervention in the case that the reactor overheats – it will automatically go into a passive state. These SMRs can supply power and heat as well as load-follow VREs at a cost of up to 10 ten times less than mining operations are currently paying for power via diesel or gas or a mixture of those and VREs. The StarCore Build Own Operate and Decommission model includes the decommissioning cost in the Power Purchase Agreement. Along with no capital cost for the project operators and lower operating (power) costs, the value received makes the cost argument irrelevant and simply used by objectors to obfuscate the benefits of nuclear power.

Safety and the Science of Radiation

A lot has been learnt about the effect of radiation on life since it was discovered around 120 years ago. It may seem strange to be declaring low levels of ionising radiation as safe because it does have the power to break molecules indiscriminately. But living tissue has the capacity to fight back and humans are always actively repairing their DNA. Doses much larger than anything emitted from a nuclear power station are used to kill cancer cells and the humans to whom they are administered go on to live for many more years.

Atomic radiation is all around us and humans have lived with low levels of radiation forever. If it were not for the DNA repair mechanism our society would have died out long ago. On safety, the anti-nuclear group rely on the concept of LNT (Linear No Threshold limit). As we have learnt more about atomic radiation that has proven to be incorrect, but the concept remains popular and limits societies around the world from utilising the most energy dense form of energy that we have immediately available to us. That does not mean that atomic radiation should be used indiscriminately. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) reports on the most notable nuclear power station incidents and report that deaths due to radiation were very few. At Chernobyl the number was 29 first responders and a further 30 due to secondary causes, the latter mostly due to poor Soviet public health responses. At Fukushima, which was a tsunami and not a nuclear incident per se, the death rate due to radiation remains at zero with a very, very small likelihood of any further statistics due to radiation. Fear-based mainstream media reports incorrectly attribute the tragic loss of lives in the tsunami to the nuclear reactor. Despite the statistics related to those incidents, nuclear power remains the safest of all power sources.

One should not negate the tragedies related to the nuclear incidents that have occurred in the last 100 years, but from those, we have learned a great deal about atomic radiation. It is not generally recognised that most of the casualties caused by nuclear bombs are due to the high energy blast and fire, not by atomic radiation.

Some survivors of the Hiroshima blast who were more than 3 km from the epicentre are now well into their 90s and Hiroshima city, including the epicentre, is open for citizens to walk around freely.

General ignorance continues around what is called nuclear waste, which is a topic often aired by people with little or no knowledge of how atomic breakdown works all around us in nature. The topic of waste from nuclear power plants is generally equated with widespread danger. This is not the case and it is important to differentiate between spent fuel and actual waste. Spent fuel is reprocessed to be used again as nuclear power plant fuel. The material that remains after that reprocessing is the actual waste. That is put into casks and encased in concrete. Those casks can be stored safely with no more danger of exposure than eating a few ripe bananas. The IAEA has estimated that for all the world's nuclear power plants since inception in the 1950s, the waste is around 28,000 m^3. While that might seem like a lot, that is a cube about 30m x 30m x 30m or around 11 Olympic swimming pools. Any atomic species with a long half-life is not, as compared to what is generally perceived, the problem. Elements with short half-lives emit more ionising particles in a short time and some of the those such as iodine 131, which is one isotope that is monitored closely, degrades to stable iodine – which is vital for human health - and undetectable above background levels within a month or two.

We have the most energy dense technology immediately available. The inclusion of nuclear energy in our electricity supply will enable Australia to make an orderly transition to a new Plan It is important that this general ignorance be addressed within the Australian political groups, together with the public.

Conclusion

Atomic radiation does not present the problems that are generally feared and the facts about safety and the externalities of 'renewable' electricity sources need to be much more widely understood. Another common argument against nuclear power is the cost. If nuclear power is indeed too costly, then let the market decide. Any proponents of nuclear power are not going to spend time and money working towards a shelf-ready proposal when the current legislation upholds the ban on nuclear power.

It's time the government of Australia showed some common sense, caught up with the rest of the civilised world and removed the clauses in our Acts that ban the development of nuclear power in Australia.

Ross Elliott

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