Responsible Future
Illawarra Chapter

Submission to:

Select Committee on Nuclear Energy

Responsible Future (Illawarra Chapter) Inc

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Mr Alex O'Brien
president@responsiblefuture.com.au
PO Box 62 Woonona 2517
responsiblefuture.com.au

Registration Number: INC2400032

SUBMISSION TO THE SELECT COMMITTEE ON NUCLEAR ENERGY

Introduction

About Us

Responsible Future Illawarra (RFI) is an independent grassroots community organisation, supported by over 16,000 individuals and stakeholders across tourism, conservation as well as commercial and recreational fishing sectors. We are not funded by fossil fuel companies or special interest groups and our focus is on promoting a transparent, balanced and informed debate regarding Australia's energy future. Our Association's Objects are "To prioritise and safeguard environmental, economic and community interests arising through renewable energy policy and infrastructure in the Illawarra."

Our focus is on promoting an informed, balanced and transparent debate about Australia's energy future. We strongly believe the transition away from fossil fuels must involve energy solutions which are cost-effective, reliable and sustainable for future generations.

Our Concerns

We are deeply concerned about the limitations and risks associated with certain renewable technologies such as Floating Offshore Wind (FOW) technology, which has been proposed for the Illawarra-Sydney region. These projects come with significant environmental, technical and financial challenges, as well as the risk of high taxpayer costs.

At the same time, we believe nuclear energy has not been given the attention it deserves in Australia's energy debate. Nuclear energy is a proven, low carbon power source that offers consistent baseload generation and can complement renewable technologies such as solar and wind.

Our Position on Nuclear Energy

We support a thorough investigation into nuclear energy as a viable option for Australia's energy transition.

This includes examining:

- The potential for **Nuclear** to provide baseload power, especially for heavy manufacturing.
- The **safety record** and technological advancements of nuclear power globally.
- The **economic competitiveness** of nuclear energy compared to renewable options, particularly given the rising costs of projects like FOW.
- The role of nuclear energy in achieving **net-zero targets** while maintaining energy security and affordability.

Our Engineering Expertise

To contribute to this inquiry, RFI assembled a team of engineers who specialise in energy systems, construction and feasibility studies. As a result, some "assumed knowledge" is embedded in this submission. If needed, members of the team would be happy to provide further explanations and supply documented evidence to support the information presented.

The team conducted over 1,000 hours of research, analysing global case studies, cost models and energy production data. This included comparisons between Floating Offshore Wind, Fixed Offshore Wind, Onshore Wind, Large-Scale Nuclear, Small Modular Nuclear Reactors, Gas and Black Coal energy generation.

Enclosed is a detailed summary of our findings, which outline the technical, financial and environmental advantages of nuclear energy in Australia's context.

We urge the inquiry to give nuclear energy the consideration it deserves and to ensure that the discussion around energy is based on facts, not assumptions or fear mongering. A diversified energy mix, with nuclear at its core, can secure Australia's energy future while protecting taxpayers and future generations.

RFI strongly supports an analysis of nuclear power as a viable alternative to the Floating Offshore Wind (FOW) the government is pursuing for the Illawarra, which we believe is not financially viable or desirable in any way.

Nuclear as a potential alternative to Floating Offshore Wind (FOW)

The purpose of this submission is to propose that the Select Committee consider nuclear power generation as an alternative to FOW for the following reasons:

Capital Cost

- The capital cost of nuclear is below $10 billion per GW.
- The capital cost of FOW is $12-16 billion per nameplate GW, based on extensive research of projects in Europe, Asia and USA - but only 35% of that FOW nameplate GW is produced; hence the need for massive overbuild of wind farms, large energy storage costs and gas firming to deliver the other 65%.

Operation and Maintenance

- The Operation and Maintenance cost of nuclear is less than FOW.

Capacity Factor

- Nuclear has a capacity factor of over 90%, based on USA experience - compared to just 35% for wind offshore in the Illawarra (according to AusIndustry report *Offshore Wind Energy July 2021*).
- That means 3 FOW projects each of the same nameplate power of a nuclear plant are needed to produce the same energy as one nuclear plant of the same nameplate power.

Operating Life

- Nuclear lasts for 60 years and in the USA nuclear plants are getting licensed for 80 years - FOW will last 20 years at best in the ocean.
- That means four new FOW projects will be needed over the same time as one nuclear plant.

Firming

- Nuclear needs no battery storage or gas peaking for firming when the wind is not generating sufficient energy - FOW needs on average 65% of the total energy to be provided by storage or firming, a very large additional cost.

Supply Quality

- Nuclear generators produce a high quality sinusoidal voltage wave form necessary for data centres, commercial enterprises and industrial applications.
- Wind requires inverters and filters to reduce the impact of harmonic distortion introduced by high capacity wind turbines.
- Australia can expect to have large data centres established for commerce and AI, operated by Google, Apple, Amazon and Microsoft. These global giants have indicated that their large data centres in the USA will be powered by dedicated nuclear plants, citing

the reliability of nuclear energy for the “always on” demand as well as the lower cost.

Skilled Employment

- Nuclear plants can be built using mostly Australian skilled workers and materials - FOW components are all manufactured overseas, mostly in China, and only assembly occurs in Australia.
- Australia already has skills in nuclear energy (ANSTO has been going for around 50 years).
- Australia has limited, if any, skills in FOW.

Port Upgrade

- FOW will need to build a large, dedicated port facility at Port Kembla to receive, assemble and maintain the FOW,
- The port will therefore need to be dredged to float the turbines, with ongoing maintenance dredging of the port probably required.
- Port Kembla is one of the preferred locations for a nuclear submarine facility on the East Coast. An FOW assembly and maintenance area in the port will not be complimentary for reasons of port space and security.

Energy Density and Environmental Impact

- Nuclear energy is the densest form of energy, requiring a small land-based area to produce 1.4 GW of steady, clean power.
- FOW at Illawarra will require over 1,000 square kilometres of ocean, which is a whale sanctuary, to produce less than 1 GW intermittently.
- That means the environmental impact and commercial impact of FOW is massive compared to nuclear - think of whale migration and other cetaceans, bird migration, commercial fishing industry, tourism industry, fish and crustacean habitat, water turbidity, collisions at sea with overlapping shipping lanes, changes to sea currents and air currents, and the massive task of decommissioning.

The Multiplier Effect

- The “always on,” high quality, cheap and clean power produced by nuclear power plants attracts other important manufacturing and service industries to the region which FOW cannot, due to its cost, low quality and unreliability.

Nuclear power generation is higher quality, cheaper, more reliable, lasts much longer, employs highly paid and skilled workers, attracts important industry, takes up little space and has minimal environmental impact. These benefits illustrate why the option of nuclear power generation should be considered for the Illawarra, instead of the current government’s plans for a 1,022 square kilometre floating wind farm between Cronulla and Kiama, 20 km offshore.

TERMS OF REFERENCE

This submission will address terms **b, c, d, e**, **and j.**

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.

b. Health and Safety

RFI is aware of epidemiological studies carried out in relation to the Lucas Heights Reactor. These studies investigated the health impacts on both staff as well as nearby residents. In summary these studies found:

"Cancer Incidence and Mortality:
An epidemiological study, conducted by the Australian Institute of Health and Welfare, assessed cancer incidence and mortality among workers at Lucas Heights.

The study found no evidence of an association between radiation exposure and cancer among the workers.

Mortality Rates:
A cross sectional survey showed no evidence of an association between radiation exposure and cancer among Lucas Heights staff. Similar findings were observed in studies assessing the health of residents in the surrounding area."

c. Environmental Impact

RFI is proposing that nuclear power generation be considered as a replacement to the current government plan for a 1,022 square kilometre floating offshore wind project between Cronulla and Kiama, 20 km offshore.

The FOW project will have massive effects on marine life and marine environments:

- whales, dolphins, fish, lobsters and sea birds,
- flora, water quality (damage, turbidity, oil spills),
- views from land, day and night.

The BlueFloat submission (which was submitted prematurely and withdrawn - source *South Pacific Offshore Wind Project application 01569* 01/11/2023 EPBC Act Business Portal) articulates **many potentially large adverse effects** and calls for detailed studies to determine how large these effects are.

These studies will be almost impossible, because nowhere else in the world has a project of this scale been built. The 193 Illawarra turbines will be floating, not driven into the seabed. There are only a total of 25 floating turbines in operation anywhere in the world, and some have already been repaired after only 3 years after breaking down. They are smaller than those proposed at Illawarra, and they are not in a protected whale migration zone.

The 280m high Illawarra turbines are in depths of 135m to 800m. They will each have massive, long chains attached to 3 immense anchors on the seabed, and huge electrical cables dangling down, running to **floating substations the size of floating oil rigs** (refer images on page 7). The chains and cables will form a barrier to whales. They will also drag along the seabed during storms, causing destruction and turbidity that may reach Illawarra's beaches.

The tips of the blades will be moving at over 200km/hr, hitting sea birds and generating noise from the turbines that will confuse marine life. Sound travels much further in water than in air and will be very loud to marine life such as whales, which can detect the sounds of other whales many kilometres away. There is also the impact of electromagnetic radiation from the high voltage cables carrying tens of thousands of volts.

Visual representation of the project by DCCEEW is deliberately misleading, on two accounts:

1. **The turbines are larger/thicker than represented by DCCEEW**, so will be much more obvious from land. At night there will be over 1,000 square kilometres of red lights illuminating the sea

2. **The huge substations are not shown**, despite the fact they will be much more massive than the turbines and will be the closest to the shoreline. There are likely to be six 500 MW floating substations positioned along the coastline. These will be **easily seen between Cronulla in South Sydney and Gerringong** on the South Coast.

Nowhere in the world is there a project like this, where impacts on the marine environment can be tested. Mathematical models will not cut it.

How can strategies for impact and management be developed in the absence of any knowledge of the type and degree of impact? They cannot.

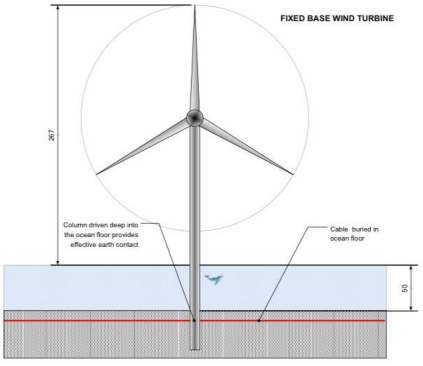
The proposed Floating Offshore Wind project off the Illawarra coastline is a huge risk environmentally and must be stopped.

In its place a 1.4 GW large scale nuclear generator would be capable of providing high quality, reliable, lower cost energy from a small land footprint, with manageable environmental impact.

One of the fixed offshore substations used at the Hornsea One project. Image courtesy of Orsted. All rights reserved.

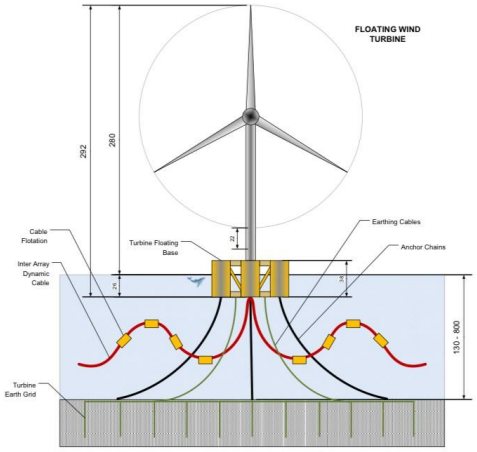
500 MW Offshore Substation - Illawarra will have six of these.

The diagrams show the environmental difference between **fixed** and **floating** wind.



The diagram above is for a fixed base turbine.

The **fixed** base can lead to collision but does not present the element of entrapment for cetaceans.
It also provides a mode of earthing for the turbine electrical supply.



Floating Offshore Wind turbines means a maze of tethers and power cables under water.

d) Energy Affordability and Reliability

Our investigations put the levelised cost of energy (LCOE) from large scale nuclear generators to be as low as **$122/MWh**. There will be no storage costs, no firming costs, no transmission costs, no distribution costs and no port upgrade costs needed on top of this.

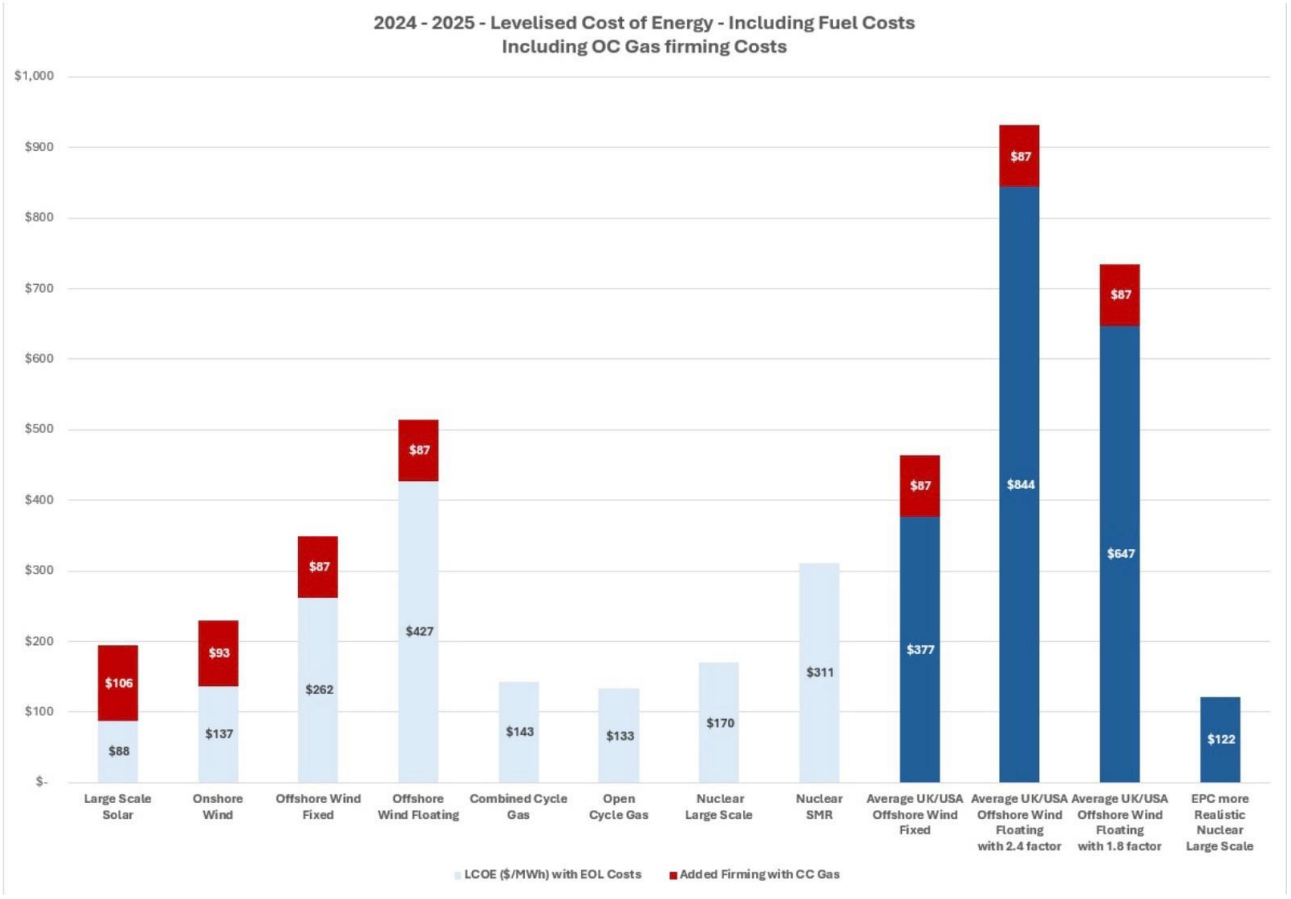
We have arrived at this figure using GenCost 2024/25 data, except a life of 80 years and a capacity factor of 90% has been used. A 6% cost of capital is used, as per GenCost, as are the O&M costs and fuel costs. Our LCOE also accounts for end-of-life (EOL) costs, which are not included in the GenCost figures.

We have had this peer reviewed by Dr Robert Barr, an industry expert in electricity systems.

Nuclear energy is the most reliable and highest quality energy generation system, with typically over 90% capacity factor and true sinusoidal frequency energy.

On the other hand, the FOW in the Illawarra would be intermittent, with a capacity factor of just 35%, will require costly storage and gas firming to back up its unpredictability, generate a poor quality sinusoidal frequency, will last only 20 years in an aggressive sea environment, will require an expensive port infrastructure upgrade and dredging, and will be expensive to decommission.

The results are shown on the graph on the below. What is not included in the FOW LCOE are port upgrade costs and transmission costs to the grid. Despite this, nuclear energy costs are more than **5 times cheaper than FOW.**



Light Blue: CSIRO GenCost data with EOL added
CSIRO multiplier from fixed to floating offshore wind: was 1.4 in 2023, raised to 1.8 in 2024

Dark Blue: RFI data from actual offshore wind farms in UK/USA with EOL added
RFI multiplier from UK data: 2.4

Cost is one of the main reasons we support the option of nuclear over FOW, which is so ridiculously expensive and demands such massive subsidies to attract developers, that it is a nonstarter in our view. The other reasons have been articulated in the introduction.

e) Economic Feasibility

Investors need certainty and this can be given by governments when there is bipartisan agreement. Without bipartisan agreement, the government could finance the building of nuclear power plants. ANSTO nuclear facility, for example, is government owned and run, so there is already expertise in Australia for nuclear.

Governments often enter partnerships with developers in infrastructure projects, where they call tenders for the construction and sometimes also operation of a facility.

This is probably the cheapest and most transparent way to develop public infrastructure. The cost of capital to government is less than the 6% assumed in the NPV analysis for LCOE. The construction and operation risk is born by the contractor, but the demand risk is taken by the government. For a nuclear plant, which provides base load power, it makes sense to operate at full capacity, thereby eliminating concerns about demand risk.

The LCOE graph (refer page 8) shows that nuclear is very economically feasible. This cannot be said for FOW. Overseas these projects rely very heavily on subsidies through Renewal Energy Certificates and/or direct government subsidies.

For instance, in Kincardine FOW in Scotland, the biggest FOW project currently in operation (a tiny 50 MW compared to the 2,900 MW planned for Illawarra), the accounts for 2023 show a $72 million subsidy and still an operating loss of $60 million.

FOW is an infant industry that is very likely to die off, especially as more nuclear is commissioned.

Why is the government pushing a power generation system that is clearly not economically feasible, yet refuses to consider one of the best power generation systems that is cheaper, more reliable, higher quality and much more?

Examples of FOW projects overseas show (after significant digging) **annual subsidies up the 10% of the capital cost.** With nuclear generation projects funded by the government, there should be total transparency, as all projects should. But renewable energy projects never are transparent. Work done by Alan Moran shows that we currently pay in subsidies **$16 billion per year** for renewable subsidies and it is growing year on year.

j) any other relevant matter

Australia's future will rely on new technologies such as AI, data mining, nuclear science, advanced manufacturing and defence. Skills in nuclear power development and operation will be essential to this future.

Surely, we cannot risk being the only G20 country not to have:

- additional skills and expertise in nuclear power,
- cheaper power for advanced manufacturing,
- civil nuclear power industry to support nuclear powered submarines.

Floating Offshore Wind projects represent a significant sovereign risk. We will be leasing thousands of square kilometres of our oceans near our ports, including where we may have a nuclear submarine base, to foreign investors who source their materials and electrical equipment from overseas, usually China.

Surely it is better from a security point of view to have our own nuclear generation plants on land.