

9 November 2024

Dr Ashley Clements  
Inquiry Secretary, House Select Committee on Nuclear Energy  
Department of the House of Representatives  
Parliament House, Canberra ACT 2600  
By electronic submission only

Dear Dr Clements,

**Invitation to provide a written submission: Inquiry into the consideration of nuclear power generation in Australia**

Sustainable Energy Now (SEN) is a WA based clean energy advocate and does not support nuclear power generation in Australia. Our submission applies to the Western Australian South West Interconnected System (SWIS) and is directly applicable to the inquiry's terms of reference.

A rational and transparent process prioritises options with the lowest economic, environmental, technological and safety risks given the applicable geo-political and technical context. Higher-risk options, like new nuclear, should only be considered where it can be clearly demonstrated that the lower-risk options have been fully optimized and developed in the planning process.

In order to frame and contain our submission along engineering and economic lines, the following items are set aside whilst recognising any one of them alone is a potential show stopper for nuclear power:

1. Federal, state and local government legal and policy frameworks
2. Liberal-National Coalition (LNP) nuclear energy political strategy
3. LNP nuclear energy outline plan
4. Ideological opposition to nuclear
5. Land acquisition and physical location
6. Traditional owner opposition
7. Community support or opposition
8. Nuclear supply chain including mining, processing, transport and waste management
9. Environmental impacts (including water)
10. Risk management / nuclear safety.

Our submission approach is that, only if nuclear power makes engineering and economic sense in the WA SWIS context, would it be worth addressing the above potential show stoppers.

Independent energy modelling by SEN on the WA SWIS (refer Addendum # 1) serves as the problem definition framework for a possible nuclear power solution. SEN's modelling aligns well with that of Energy Policy WA (EPWA) and the Australian Energy Market Operator (AEMO) with general agreement on the technology pathways for the SWIS. It is apparent from this modelling and analysis that:

1. Renewables (primarily wind and solar), firmed by batteries and with gas generation acting as peaking supply and long duration energy storage is the least cost pathway;
2. The contribution from renewables on an annualised energy basis ranges across the modelled scenarios with an end state vision being 80-90% renewables with fossil gas and / or liquid fuels providing the balance.

We recognise getting to net zero with a fossil fuel option poses a challenge, however there are a wide range of potential alternative technological solutions available. We asked ourselves could nuclear power be one of those potential solutions, in whole or in part?

We systematically addressed the problem context and identified the required solution attributes from a technical and economic perspective. We then comment on how nuclear power engaged with those requirements as noted below:

1. **Domestic rooftop solar is the defining feature of the diurnal energy mix** – rooftop solar continues to grow and now dominates the energy mix from a design perspective to the extent that any complementary power generation needs to be flexible to ramp-down when solar output is high during the day and ramp-up in the evening and night when solar output is zero. The concept of baseload demand and hence ‘baseload power’ (there is a good explanation of baseload power [on our website](#)) is no longer applicable. Large scale generation needs to respond to the operational demand which is the demand net of rooftop solar’s contribution. **Nuclear power** plants need to operate at a near steady output and with a high-capacity factor in order to optimise its levelised cost of energy. ***Nuclear Power therefore fails to meet the criteria of technical and commercial flexibility to work with a renewables dominated grid.***
2. **Large scale renewables require large scale back-up** in the event there is a long wind drought combined with low solar output as indicated by our modelling. Inter-seasonal, inter-annual and inter-decadal weather patterns need to be considered when selecting and sizing Long Duration Energy Storage (LDES). This LDES requirement is currently catered for in our modelling, and that of EPWA and AEMO, by using fossil gas acting as stored chemical energy. LDES can be chemical, thermal, mechanical, or electrochemical - one common LDES option used elsewhere in Australia but not available to WA at scale is pumped hydro storage. The selected LDES solution currently dictates a large gas generation capacity (GW) but with a low throughput ,i.e. PJ of gas consumed or TWh of energy generated. Aside from occasional test runs, gas generators can sit idle for months at a time before being operated for relatively short periods of time for firming or back-up. Whilst the cost per MWh for gas generation in that service is high for that short period of time, those costs can be amortised over the annualised energy cost. To fill this firming and back-up role in the WA SWIS, our modelling for the 2030 case using EPWA’s ‘Future Ready’ scenario in the SWIS Demand Assessment, indicates around 6GW of gas generation capacity is required. **Nuclear power** is not cost effective when operated in this firming and back-up role and it would be prohibitively expensive for nuclear power to provide the required back-up generation capacity. ***Nuclear power therefore fails to meet the requirement as back-up to renewables.***
3. **Rising demand** – EPWA and AEMO regularly publish demand forecasts and related scenarios. Forecasts indicate a relatively rapid increase in electricity demand over the next 20 years, caused by fuel switching from fossil fuels to electrification, including in the transport and industrial sectors. Energy modelling by SEN, EPWA and AEMO all identify the least cost pathway to meet that increased demand is via renewables (primarily wind and solar) firmed by batteries and gas as noted. There is

not a scenario where electricity demand increases to the extent that requires the use of nuclear power in that least cost pathway. It is also worth noting that the new generation needs to be deployed quickly to meet the forecast demand growth. ***Nuclear Power is not required to meet rising electricity demand*** - this can be met in a timely manner by firmed renewables (subject to timely Government investment in common user infrastructure).

4. **Wholesale Energy Market (WEM) operation and investor risk.** Western Australia's WEM operates on the SWIS with energy and auxiliary services traded in markets governed by a regulatory framework. Households, private companies and Government Trading Entities have all made long term investments in establishing businesses and generation assets based on these rules. In the event a government owned nuclear power plant was introduced to the SWIS as a base load generator it would require extensive changes to the regulatory framework. Other generation on the SWIS (including rooftop solar) would need to be curtailed or ramped down to accommodate nuclear power. This would significantly devalue that prior investment and create significant investor uncertainty. ***Nuclear power therefore represents considerable investor risk, it would undermine Australia's 'free market' credentials and significantly erode trust in the Government and institutions at a time when trust needs to be bolstered.***
5. **Energy Prices** – following on from the scenario above and based on the current WEM settlement rules and using CSIRO's levelised cost of energy for nuclear power (these are the most accurate figures currently available), wholesale energy prices would rise. This is because more expensive nuclear power facilities operating in base load mode would increase prices in all of the WEM energy market settlement periods. ***Nuclear power would therefore increase wholesale energy prices and / or require additional taxpayer subsidies to keep energy prices stable.***
6. **Emissions Reduction** – for nuclear to displace fossil gas or distillate fuels in the energy mix to reduce emissions, a large quantity of nuclear energy capacity (circa 6GW as per SEN 2030 modelling case) would be required which would be prohibitively expensive as previously noted. It is worth noting that SWIS power generation related emissions represent only around 10% of the State's overall emissions. Therefore, there are many other more cost-effective means of reducing WA's rising emissions other than using nuclear power for SWIS power generation. ***Nuclear power fails the emissions reduction requirement.***
7. **Energy security** – rounding out the energy trilemma of security, cost and environmental impact, could nuclear power increase energy security? The LNP are proposing a small modular nuclear reactor of around 500MW for WA at Collie. This is less than 10% of the 5,859MW of registered generation capacity on the SWIS (as of November 2024) and so would have minimal impact on energy security, especially when base load operation combined with the 'N-1' risk is considered (N is the number of generation units, with N = 1 in the LNP proposal). The unplanned loss of such a large single generator would in fact reduce overall energy security. ***Nuclear power would reduce energy security. Note:*** There are a number of more effective methods for achieving energy security and resilience in the face of climate change effects. For example, households and a number of small and medium sized businesses energy security can best be achieved cost effectively by electrification, rooftop solar and behind the meter battery storage.

8. **Timely solution** – the energy transition is moving quickly, although not quickly enough according to multiple sources including the International Energy Agency<sup>1</sup>. Modelling by SEN, EPWA and AEMO all highlight that the missing piece in the SWIS energy transition puzzle is flexible, large capacity, long duration energy storage. A number of solutions identified below are maturing at a rate that would allow deployment individually or collectively at scale at residential, commercial and industrial levels. This deployment will continue to erode the use of gas generation and completely negate the nuclear power business case. These potential solutions include, in no particular order: energy efficiency, demand side management, customer energy resources optimisation, improved / new batteries, virtual power plants, home energy management systems, offshore wind, rooftop solar inverter control and management, vehicle to grid, pumped hydro energy storage, hydropower, thermal storage (for direct heat transfer or for power generation), geothermal, bio-gas, bio-fuels, multi-sector fuels, wave and tidal energy, compressed air storage, liquid air storage, concentrated solar power, gravity storage (very unlikely), and green hydrogen (unlikely in an energy context). The LNP proposal of seven nuclear plants built, presumably sequentially to capture the learnings and manage supply chain, would take years to plan, build and commission by which time other more cost effective and readily deployable technology will have well and truly solved the problem. **Nuclear power is not a timely solution option.**

So overall, whilst considering just the limited selection of technical and economic criteria, they **clearly demonstrate that nuclear power on the SWIS** (and probably on the NEM for similar reasoning) **is a non-starter**.

SEN looks forward to providing civil society and community input into the WA clean energy transition.

Yours sincerely,

**Fraser Maywood**  
Chair, Sustainable Energy Now Inc

#### **Addendum # 1 SEN SWIS 2030 Modelling**

**Submission approved by the SEN Committee on 8<sup>th</sup> November 2024 via circular resolution**

*Sustainable Energy Now ([www.sen.asn.au](http://www.sen.asn.au)) formed in 2006 is a grass-roots not-for-profit member based advocacy group promoting renewable energy and decarbonisation. Supported by the best science and our own modelling and simulation, we advocate on how Western Australia can make a swift and orderly transition to clean renewable electricity safely, reliably, and affordably with commercially proven technologies.*

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<sup>1</sup> IEA World Energy Outlook 2024 <https://www.iea.org/reports/world-energy-outlook-2024>