

Select Committee on Nuclear Energy

Please find my submission to the Committee attached.

I thank you for the opportunity to contribute and wish you well in your consideration of these matters.

Trevor Woolley
Retired Power Systems Engineer

Career Summary Trevor Woolley

Trevor worked in the Electrical Supply Industry for 39 years prior to retiring in 2014. He spent 30 years as Power Systems Engineer at Bayswater Power Station. During this time he was involved in the operation and maintenance of the large electrical equipment at the power station including grid connection and generator performance standards.

Since retirement Trevor has maintained has connection with the Electricity industry including acting as a consultant on Electrical Protection and other matters.

Trevor was also an early adopter of Solar Energy. He has lived off the grid since 1990. Adopting and living new technology. Trevor is well on the way to an all-electric renewable lifestyle with house, cars, water pumps, mowers and hand tools all powered by renewables.

Nuclear is Not the Answer

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Nuclear Is Not the Answer

Executive Summary

The correct time for the nuclear debate was 15 – 20 years ago, however, successive governments have chosen to allow the industry to be market driven and not made any policy. It is now too late to have the debate. Renewables are here now and already contribute 40% of the energy to the grid.

Nuclear power will take at least 15 – 20 years to be implemented at scale. The grid needs new generation NOW. The ageing coal fleet MUST be replaced in the next 10 years. It is old and unreliable. Maintaining 40 – 50 year old coal generators in service is extremely costly and you still have an old power station. There is a reason that there are not many 50 year old cars on the road!

There is also a climate imperative that we reduce emissions. Nuclear cannot achieve that within the time frame required.

New coal generation cannot be built in the time frame required.

The only technologies that can be built in the required time frame are solar, wind, small scale pumped hydro and gas turbines. None of these can be built quickly so unless the planning process is already well underway, then the project will just not make the time frame.

Nuclear is hugely expensive much more so than batteries, solar and wind. Refer CSIRO report. Importantly, for the last few decades, the cost of batteries, solar and wind has been on a downward spiral. Nuclear is on an upward spiral, particularly in America and Europe. That is unlikely to change.

The nature of the electricity grid is changing rapidly. It is totally different from 20 years ago. High renewable penetration requires the ability to respond quickly to changes in conditions. The grid must be able to store power and to generate power and to change quickly. Large steam turbines – whether driven by coal or nuclear generated heat - cannot respond quickly enough. Batteries, large and small scale hydro and to a lesser extent gas turbines can respond quickly.

The nature of technology advance is to reduce the number of job. Modern Nuclear Power Stations are no different – the number of locally based jobs will be significantly less than in an equivalent, old coal fired power station.

The Australian grid(s) began in the 1920's and were diversified and regional. There was little interconnection. Reliability was low. Large scale interconnection began in the 1950s. Large Electricity Commissions were formed in each state and large centralized generation established. In the 1980s state interconnections were increased and the market formed. Centralised, reliable and large scale was thematic.

Technology and economics has now moved on. We now have the technology that can establish reliable local / regional based supply using large and small scale diversified and distributed generation and storage. Individuals, towns, businesses and regions have the ability to power themselves from solar and batteries. The large grid is no longer essential for many customers. When investing in Nuclear for a supposed 80 year term there is a real risk that new /other technologies will strand the nuclear asset – possibly even before it is completed. How do you justify a Nuclear Facility if no one wants your power?

Social and political hatred and fear is being bred by politicians and large fossil and nuclear based companies. It is out of control. The process of planning and developing new generation must be turned around so that the local and regional communities benefit from the development and can embrace the change.

Planning large infrastructure is a highly technical task. The results of robust technical studies must be used to make decisions. AEMO, CSIRO and the industry have all extensively calculate the resources available, the interconnections required and the grid dynamics and know what is required. Their advice should be respected and acted on.

AEMO and inverter supply companies have co-operated in the development of Grid Forming Inverters. This is world leading technology and has effectively removed the need for large rotating machines from coal and nuclear generators to keep the grid stable. The technology has been proven extensively in South Australia, California and Texas. Diversified and distributed grids are now reliable and controllable.

The best technical solutions are the best solutions. Let's move on and use modern technology not 1950's nuclear technology. Australia has the best renewable resources in the world.

As with photography, printing and communications, technology has enabled a move away from the specialist to the popular. Renewables has given the ability for the population to control their own energy.

Strive for social cohesion and wealth. Modifications are required to the planning process and the electricity rules and regulations so that communities, businesses and individuals benefit from the new technology. This should be our focus.

Thanks for the opportunity to contribute.

Trevor Woolley
Retired Power Systems Engineer

WHY NUCLEAR IS NOT THE ANSWER

1. Nuclear will be too little too late for grid.

AEMO and others have published extensively on the need for new generation and transmission within the next 5 to 10 years to replace the aging coal fired units. Refer to AEMOs Integrated System Plan. [AEMO | 2024 Integrated System Plan \(ISP\)](#)

The need for new generation is a real and physical need that cannot be just pushed aside on a political whim. It is impossible to establish a network of nuclear generators to replace the existing coal fired power stations within this time frame. To keep the grid operational for the next 20 years it is essential that new generation is installed now.

2. Technology that can be installed within 5 – 10 years.

There are established industries currently building solar, wind and storage. These technologies can be established on a large scale within the required 5 – 10 years and the industry is already in place to support them.

Small scale pumped hydro can be established IF planning and design is already significantly advanced. The industry for the required civil and electrical works is established.

Gas turbines can be established within the timeframe if planning is already in process, however, the availability of gas is severely restricted and emissions from the gas fuel cycle are unacceptable high for continuous use for generation.

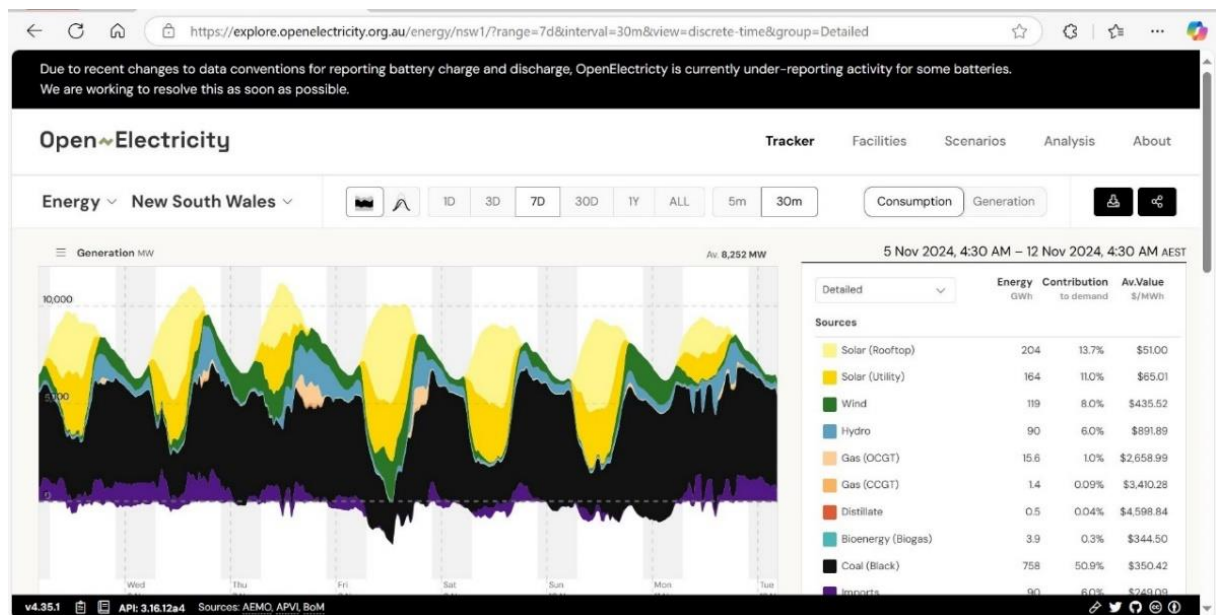
3. Suitability of Nuclear Generators within a Renewable Grid.

An electricity grid with a high penetration of renewables requires all market participants to be totally flexible. Any large steam turbine based generator, whether fueled by Nuclear or Coal, will not be sufficiently flexible to co-ordinate safely within the grid. The machines are limited by their size and metallurgical restrictions on how fast temperatures can change. They are machines that are just not suited for the modern grid.

Much is made of the need for “base load” generation to ensure grid reliability. 30 years ago, base load was a real thing. If a machine was base load, it was kept loaded 24 hours a day.

In the modern grid there is no base load because the output from renewables is constantly changing. This is well demonstrated on Friday 8 November when the contribution to NSW load from renewables was over 90%. This is a record, but not an isolated one. Without flexible generation and flexible storage options, the grid cannot be reliable and stable. Refer to the picture below. The installed renewable capacity of solar and wind can now power the state in the short term. Installing more renewables and storage is the path to a reliable and clean system. As more renewables are installed, there will be no room for major units on the grid on a frequent basis.

Note: The picture shows the NSW generation for 7 days. Yellow are solar, green is wind, coal is black. Exported power is purple.



Refer also to an article in RenewEconomy

[Wind and solar take record 93.7 per cent share of Australia's biggest coal grid | RenewEconomy](#)

4. Need for a Nuclear Regulator

All overseas countries with a nuclear industry have a nuclear regulator. This regulator has the power to examine and regulate plant. ARPANSA is Australia's regulator and the authority to establish a safe nuclear industry must rest with them and not with the government. The regulator MUST be independent and expanded.

Callide Power Station failed catastrophically in May 2021. Refer AEMO report "*Trip of multiple generators and lines in Central Queensland and associated under-frequency load shedding on 25 May 2021*". The base cause was inappropriate corporate risk-taking overriding obvious technical shortfalls and operational risk.

Broken Hill and NSW Western Districts were blacked out in October 2024. The blackout should not have occurred because the ability to sustain Broken Hill and the western grid as an island was foreseen, regulated but not implemented. Again the base cause was inappropriate corporate risk-taking overriding obvious technical shortfalls and operational risk.

Prevention of events such as those above is the realm of Reliability Engineering. Reliability in machinery depends on redundancy and duplication of all plant that contributes to reliability. This is expensive and the need is not evaluated correctly by commercial interests. The redundancy and reliability required for an electricity supply must be regulated.

The electricity regulator AER and operator AEMO are federal government agencies responsible for ensuring a reliable electricity supply. It is obvious from the above massive failures by market participants that the current regulators need more power to intrusively investigate and regulate the operations of market participants. Any nuclear regulator must also have these powers.

In a nuclear world, events such as those at Callide and Broken Hill can result not just in blackouts, but in a massive release of nuclear poison. Why take this risk?

To quote one maxim of one boss of the old Electricity Commission of NSW,
“The most expensive electricity is no electricity”
Wise words that may have been largely forgotten in today’s commercially focused world
unless prompted by catastrophic such as those above.

5. Time to establish Regulations

Failure to establish and implement proper standards and regulation will lead to cost cutting
and corporate greed minimizing safety and other standards.

Development of a nuclear industry must not begin until the regulator has finalized the
regulations and standards required. The regulations must cover safety standards and
mandate highly redundant design. In addition, Australian Standards for electrical equipment,
construction codes, building codes etc must all be mandated by the regulations. Importing
equipment that meets other standards is not acceptable.

The process of establishing regulations must not be rushed and must be completed carefully
and fully. Overseas regulations can be used as reference but must not be imported complete
and without alteration to suit Australian conditions. Time must be allowed to establish these
regulations. The whole process has safety written all over it. Failure to get the regulations
correct at the beginning will cost time, money and safety before completion of the project.

6. Time to Plan and Construct a Nuclear Power Plant

A multi-billion dollar facility of any kind cannot / should not build without an extensive
specification, tender process and a large water tight contract. The specification must be
detailed and in particular require all the plant to be built to existing Australian Standards.
Many Australian Standards are closely aligned to European Standards but not exclusively so.
North American, Japanese and Chinese Standards are significantly different from Australian
Standards. This writer has experience in importing equipment from both North America and
China. Safety and reliability problems resulted. Modifications to the plant were required to
make the plant safe and reliable.

It is imperative that Australian Standards are mandated for all the plant and this will require
extensive design and review during the tender process.
This process can and should take time. It can and should take several years of intensive
work.

7. Local Jobs

Promises by politicians of local jobs in a nuclear power station are not founded in fact. The
number of local jobs will significantly less than in an equivalent coal fired plant.

Jobs during construction

Large conglomerate companies – particularly those from Asia - use their own staff for
construction. The requirement is always for “factory trained specialists”. There will be some
work for local staff, but the majority of highly skilled labour will be imported. This is just the
way large conglomerates work. There will be jobs for locals but they will not be the highly
skilled ones.

Maintenance Jobs

Those familiar with Coal Fired Plant tend to think of hundreds of jobs required to operate,
maintain and clean a plant. Those familiar with coal fired power stations also know that the
majority of operating, maintenance and cleaning effort is spent on the Coal Handling Plant,
Ash Plant, Milling Plant and Boiler.

A Nuclear power station does not have a Coal Handling Plant, Ash Plant or Milling Plant. In addition, the reactor vessel does not have abrasive coal and coal ash being blown past heat exchanger tubers, so reactor maintenance is significantly less than boiler maintenance. In short, the day to day maintenance and operating effort in a nuclear power station is hugely less than in an equivalent coal fired plant.

Major outages, including refueling outages will occur every 4 – 8 years. Maintenance effort will be concentrated in that short time frame using imported “factory trained experts” not local labour.

Operating Jobs

With no need for an ash plant, coal plant and milling plant the day to day operating jobs are reduced to those required to monitor the reactor and turbine and for the supply of cooling water.

Operations of many nuclear power stations are done remotely. Operating the plant on a 24 hour basis may well be done remotely and be a condition imposed by the supplier in the contract. This will further reduce local jobs.

The most significant local jobs will be armed security guards patrolling the perimeter fence – and being bored stiff.

8. Social and Community Concerns

Explaining Renewables

The operation of large grids with high renewable penetration has been studied carefully by AEMO, CSIRO and other technical organisations. It has been clearly shown by calculations, modelling and in practice that cheap and reliable electricity can be provided by renewable.

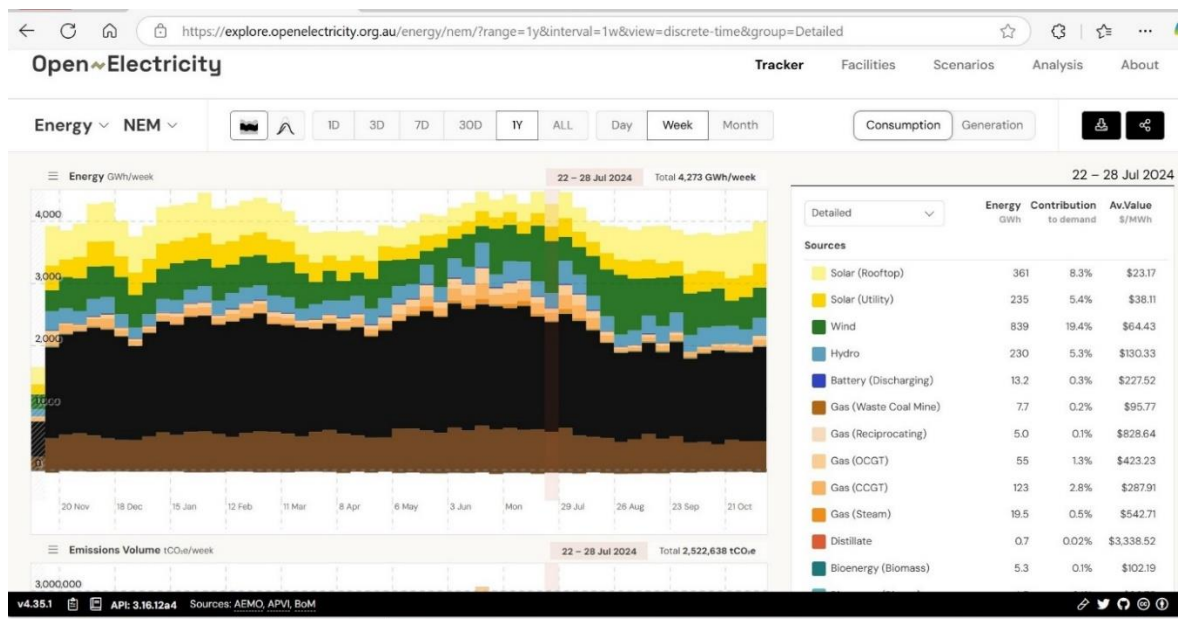
There is little understanding within the population on how this can be achieved. The simple but false “what happens when the sun don’t shine and the wind don’t blow” argument is easily promulgated and adopted.

The operation of how renewables and storage can be used during wind droughts and cloudy weather needs to be explained to the population. There is more than sufficient data available for existing sources to achieve this. It needs careful explanation in simple and straightforward manner without spin.

The coal based grids are only “reliable” because of massive redundancy in all levels of generation and transmission. A renewable grid can be reliable due to redundancy, distribution and diversity. This needs to be explained.

Websites such as OpenNEM [Open Electricity: New South Wales](#) and NEMWatch [Live Supply & Demand Widget, sponsored by RenewEconomy](#) are easy sources of information to understand how renewable work.

For instance, from OpenNEM, a 12 month picture of renewable generation on a NEM wide basis shows that solar (yellows) and wind (green) are quite consistent throughout the year on a week by week basis. That is why transmission lines and storage are important to allow the distributed power to be transported to loads. This is not well understood by the general population.



Benefits to Communities.

Development of renewables must use the new technology for the benefit of local and regional communities.

Renewables can provide wealth to rural communities. The wealth can sustain the communities during drought and agricultural downturns. Providing these benefits to community must be the focus of development processes and approvals.

Distributed renewables can provide reliability to local communities and businesses during unusual events and emergencies. Every town has a substation on the edge of town and a paddock next to the substation. A suitably sized solar and storage installation with grid forming inverters can provide the town with reliable electricity during events such storms, flood and fire even if there are disruptions to the supply from the grid.

This reliability and independence is of high value to regional towns, the businesses and individuals, but this is one feature of renewables that is not being allowed by current electricity rules and not encouraged by planning processes. The electricity rules and the planning systems need to change.

The current planning process is used by major conglomerates on a piece meal basis and by negotiations with only a small part of the community. This is creating an unequal benefit to society. There are places where renewables should not be installed. For instance, solar should not be installed in a fertile wheat paddock – even if it is next to an existing substation and connection will therefore be cheap. The planning processes need to include correct selection of land use.

Politicians who are currently spreading fear, hatred and anger within the community need to focus instead on bringing benefits to the local and regional communities on an equal basis across the community. The wealth is there. It needs to be distributed.

9. **Other Matters**

The Electricity Market was developed to allow state owned enterprises to compete for generation using established the existing large Coal Fired Generators. The market is based on allowing the generation companies to maximize their profits. The market is not designed to give consumers cheap electricity nor to benefit communities. Major international and local corporations are now flocking to Australia to make large profits for electricity consumers.

The market is unsuitable for providing cheap electricity to the population. Market and planning rules can and must be changed so that the wealth is distributed evenly through the community.

Analysing rules changes is beyond the scope of the submission, however a list of rule changes that would focus the market to community benefits is below.

1. Redundancy and security must be rewarded – particularly when the penetration of renewables is high.
2. Dismantle the FCAS market dismantle and regulate that all generators must provide these services.
3. Black start facilities must be provided by all generators and the ability for local islanding of the grid must be provided for all towns.
4. Allow distributors to install batteries to off load local grids.
5. Risk must be communicated to AEMO on a daily basis. Strengthen AEMO ability to audit risk and plant design. Connection agreements must be strengthened.
6. Grid participants must train operator, engineers and managers for catastrophic events.
7. Eliminate rebidding and massive price increases. Prices to be held constant for all day or all week.
