SUBMISSION TO AEMO

Re: Draft 2024 Integrated System Plan

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Introduction

The plan has put forward one possible solution for future electrical energy supply by 2050, but it is by no means clear that this is the optimum development plan to support a reliable, secure and affordable NEM.

Total supply by renewable energy generation has inherently low levels of security and reliability and must be supplemented with energy storage and dispatchable means of energy generation. In the plan presented, gas fired generation is used as the dispatchable power source which in many respects compromises the objective of future zero carbon emissions. This compromise may be a matter of degree, however there is a balance between the amount of storage provided and the level of dispatchable power installed, as well as other options including base load nuclear power.

The complete absence of any consideration of nuclear energy and base load generation is a serious omission and there seems to be no consideration of different relative levels of wind and solar PV generation, or excess renewable capacity, and the impact on energy storage requirements. It is these aspects which should form the basis of an optimisation study to define the final target mix of generation and storage facilities applicable in 2050. How to reach that position with progressive closure of coal fired generation and the pace of that change should follow, together with consideration of the three different scenarios mentioned in the plan document. The transition plan needs to consider the impact on the Australian economy and needs to be relatively flexible to accommodate changing circumstances.

Nuclear energy.

Nuclear energy is a highly developed source of carbon free dispatchable electrical energy which cannot be ignored. The absence of any consideration of nuclear energy and even arguments why it should or should not be considered, suggest an ideological agenda of only considering renewable wind and solar PV, and yet the proposal reported includes gas fired generation as a security and "firming" measure with on-going carbon emissions.

The CSIRO GenCost Report 2023-2024 grossly misrepresents the cost of nuclear power and the potential practicality of its application in Australia. This aspect of the CSIRO Report is in serious error, quoting capital costs of $31,000 per kW based on escalating the cost of one failed small modular reactor project compared with present overnight capital costs of reactors in the USA of US$4,200 to $6,900 per kW and expected SMR costs of US$3,000 to $8,000 per kW. That report needs to be completely revised and this has been covered in a separate submission.

It is also not sufficient to dismiss the nuclear option by a simple comparison of basic LCOE costs, since there are other cost implications with renewable energy use. These are the extended grid connections required, loss of valuable agricultural land, energy storage required, and risk of supply failure under extreme weather conditions and any backup required to deal with it. Nuclear plants will operate for 50 years requiring at least one renewable generator replacement within that time. The inclusion of nuclear within the mix of generating facilities will not only reduce wind and solar capacity but will substantially reduce energy storage requirements and any security backup facilities. This will become apparent with the assessment of the total annual cost of a particular mix of generation and support facilities, and it is the total annual cost of the system to meet a specified demand which must be optimised.

Energy Storage and Optimisation.

Energy storage is needed with variable generation (wind and solar PV) to be able to meet the energy demand. It is suggested that there are three aspects to storage:-

1. Variations during one day, particularly resulting from solar PV with the peak at midday and zero from sunset to sunrise. This can be covered by battery storage with a capacity of around 4 hours at the supply capacity of the renewable energy.
2. Seasonal variations which reflect both reductions in energy output during winter as well as seasonal demand variations such as due to different heating and air conditioning loads. This could be covered by long term storage such as pumped hydro (PHES) or by oversizing generating capacity (solar PV in particular).
3. Extreme weather conditions reducing energy output for extended periods which could be several successive days. This requires long term PHES, or alternative back-up generation as proposed with the use of gas turbines. The use of maximum base load nuclear generation will have a major impact on this requirement as at least that base load supply is always available.

Energy storage at 2050 is given in the ISP as 50 GW and 654 GWh. This is close to the requirements for daily variations only, as indicated in item 1 above. It also represents around 0.15% of annual demand or around 13 hours of demand, which under the circumstances of predominantly renewable supply is considered to be inadequate to also meet the other storage requirements.

It would appear from the ISP that for 2050 all the energy generated by wind and solar is utilised in meeting demand without excess capacity. Additional energy is supplied by gas fired generation, operating at times of significant shortfall in renewable supply. Energy storage is also needed to balance supply and demand such as items 2 and 3 above, although is likely to be inadequate and must rely largely on gas fired generation. Gas fired generating capacity is given as 16.2 GW. This is capable of supplying 120 TWh per year which is 27% of total demand. However, it is indicated that it will be operating only 5% of the time providing around 6 TWh per year which is 1.35% of annual demand. To some degree emergency gas fired generation could also be replaced by a marginal addition to renewable capacity and additional storage capacity.

The cost of fuel and fixed operating costs for gas generation (excluding amortisation) is estimated at $180/ MWh of electrical energy supplied, which is higher than base load nuclear generation. If base load nuclear is included at up to 35% of total supply, then energy storage and gas generation can also be substantially reduced, offsetting the cost of the nuclear facility.

It is suggested that optimisation of total system costs in this way will most likely result in a mix of generating facilities that will include nuclear if realistic unit costs are used. It will also be possible to minimise or even eliminate the use of gas fired generation. The basis for this optimisation must involve the modelling of the total energy supply using a full year (or more) of typical day by day weather data to determine total energy output as a function of time. This will allow energy storage and any supplementary gas fired generation to be determined for each defined mix of generating facilities.

It is not adequate at this stage to provide a plan giving one preferred future energy mix without including various generating options and without demonstrating the total system costs under different scenarios to fully justify the selection made.

Mention is made of hydrogen as an alternate fuel for emergency generation although it is presently too expensive. It should be noted that the use of hydrogen generated using electrical energy would be grossly inefficient and direct energy storage is likely to be more cost effective.

Path to 2050.

Given the defined final position for 2050 it is then a matter of selecting the path including the schedule of progressive closure of fossil fuel fired generators and progressive addition of new renewable generation and energy storage facilities. This should define the progressive costs of energy delivery to ensure that total electricity costs transition to the final configuration in a uniform manner. It should also ensure that the system remains balanced, stable, and manageable at all times, and that changes do not occur prematurely before the system is able to handle the change. This might mean always having adequate energy storage or residual backup generation. This aspect of the path to 2050 is certainly not clear in the report or any indication of changes in the cost of electricity over time.

Conclusion.

Without the provision of cost information for the plan and details of different options it is not possible to adequately answer the questions posed in the Guidance on written submissions. However, it is most likely that the proposed system will be less secure and affordable than if a high level of base load nuclear generation is included.

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