5 July 2024
The Hon. Paul Scully MP MLA
Member for Wollongong
Minister for Planning and Public Spaces
Parliament of NSW
E: wollongong@parliament.nsw.gov.au
E: office@scully.minister.nsw.gov.au

Dear Mr Scully,

**Validity of claims by Renewable Energy Proponents re No. of Households Served by proposed Generators**

**Executive Summary**

From an analysis of real generation data for an example solar farm, coupled with a reliable set of household consumption data, it is shown that the claims made as to households served and the scale of battery storage required for a particular proposed solar farm in NSW are, quite simply, considerably overstated. These findings beg the question as to how many other such proposals, perhaps already approved by Planning NSW and the Independent Planning Commission (IPCN), have made similar, untested, claims.

There are several important consequences of these overstatements by proponents.
1. To service a given expected level of Demand, always an essential metric for which to have a reliable estimate, if it is found in subsequent operation that proponents have wildly overstated the demand that their proposed generators might service, then either far more generators will have to be built, posing significantly increased environmental and social impacts, destruction of valuable farmland, etc., or, where not addressed, massive Statewide power shortages will be the inevitable consequence.
2. Addressing any serious shortfall in battery storage would require a massive increase in the number of BESS installations, resulting in similarly vastly increased social and environmental impacts, and a massively increased fire hazard to surrounding regions, the latter resulting from the inherent safety issues endemic in the Li-ion battery technology itself.
3. Massively increased waste disposal issues resulting from the hugely increased resource requirements. It is to be kept in mind that solar panels do not last 25 years as claimed by proponents, and batteries, from the Hornsdale experience, have a service life of less that 10 years.

To give some idea of how far wrong the proponent is in its calculations, even with a battery storage equivalent to 450 Geelong Big Batteries, a number which would be impossible to fit into the selected site, the proponent's solar farm can never supply 262,000 homes.

This poor performance needs to be considered in conjunction with such as the spectacularly poor performance of wind generation across the Eastern Australian grid during the present calendar year. Wind's poor performance occurs frequently, if chaotically. In this background, to consider the further closure of coal-fired generation in the hope that wind plus solar generation plus battery storage will replace it is best described as an extremely dangerous policy.

**Introduction**

So often we see the claims in proposals for Wind and Solar Farms, or other such renewable energy facilities, that for any given proposal, the proponent claims that, it will "power so-and-so-many thousand homes". How valid are these claims and how readily might they be checked?

I thought to examine one such claim and to provide my findings to you as the Minister responsible for the Planning Approvals process here in New South Wales.

The starting point for any such analysis is the obtaining of reliable data as to the average household consumption of electricity in NSW.

In searching for official data on household electricity and gas consumption, I found the publication by the Australian Energy Regulator (AER) entitled:
"*Residential Energy Consumption Benchmarks*", published on 9 Deccember 2020,
and available at:
https://www.aer.gov.au/system/files/Residential%20energy%20consumption%20benchmarks%20-%209%20December%202020_0.pdf

I have chosen data from that very comprehensive document for what the authors refer to as Climate Zone 5. See Table 16 on page 37. According to the preamble in section 4.2.4.Climate Zone 5:

"*The sample includes 1,908 households in Climate Zone 5. This includes 1,339 in New South Wales and 505 in South Australia. Climate Zone 5 covers several metropolitan areas including greater Sydney and Adelaide. The remaining 64 are in Queensland, in a small pocket to the immediat west of Brisbane.*"

I have chosen the Climate Zone 5 data as being representative of the household consumption patterns in the region of Eastern Australia in which the particular proposed project is to be sited. From that same Table 16, I have chosen the data as representative of households in NSW, that is, covering the wider region within which the proposed project is to be situated, and which therefore it is most likely to supply. Climate Zone 5 Table 16 data for NSW is reproduced below:

"*Table 16: Climate Zone 5: Electricity consumption benchmarks by household size (kWh)*"

| State/Territory | Household size | Summer | Autumn | Winter | Spring |
|---|---|---|---|---|---|
| NSW | 1 | 732 | 745 | 927 | 705 |
| NSW | 2 | 1,278 | 1,232 | 1,565 | 1,162 |
| NSW | 3 | 1,530 | 1,503 | 1,903 | 1,425 |
| NSW | 4 | 1,819 | 1,717 | 2,148 | 1,627 |
| NSW | 5+ | 2,158 | 2,082 | 2,761 | 2,007 |

For my analysis, I have chosen the line in the above table for a household of 4 persons. What I did was to use the seasonal average consumption of a representative household of 4 persons in conjunction with 5-minute AEMO SCADA data for a representative generator, scaled to match the specifications of a solar farm proposed here in New South Wales for a similar location.

**Preliminaries**

For this analysis, I chose the claims made by the proponent for the Birrawa Solar Farm, a proposal that is, I understand, presently before NSW Planning for consideration.
At the proponent's website: https://acenrenewables.com.au/project/birriwa-solar/
under the opening heading "The project", the following relevant claims are made:

1. "*It will generate enough energy to power approximately 262,000 average Australian homes.*"

2. “*The solar component of the project will have a capacity of around 600 megawatts (MW) and include a centralised Battery Energy Storage System (BESS) of up to 600 MW for 2 hours. The BESS will enable energy from solar to be stored and then released during times of demand.*”

The Issued Scoping Report at:
https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-29508870%2120211012T060833.452%20GMT
provides the further relevant information that, *“Birriwa Solar Farm which includes:*
- *the construction and operation of a solar photovoltaic (PV) energy generation facility with an estimated capacity of up to 600 MW; and*
- *associated infrastructure, including grid connection and battery storage of up to approximately 1,000 MW (with an energy storage duration of up to four hours).”*

From these statements I have presumed that: the Solar Farm is to have a capacity of 600 MW, and the Battery Energy Storage System (BESS) will have a capacity of 4000 MWh (1000 MW output times 4 hours).

**Analysis - Ability of the Solar Farm plus BESS to supply the claimed number of households**

It is an oft-overlooked fact, where renewables proponents discuss the performance of wind and solar generation in terms of average outputs, that solar panels produce no electricity whatsoever at night, all night, every night, 365 days per year, (includes leap year nights too!).

Any associated battery storage must therefore make up the supply shortfall, this being the full requirement of any power generated by the solar facility, for an average of 12 of those hours, at the very least, of every 24-hour day of the year, (the 12 hour period being an average value for the period commonly known as “night-time”, or “darkness”).

The proponent states that the proposed BESS has a storage capacity of 1000 MW times 4 hours, providing a potential maximum battery storage capacity of some 4000 MWh.
Presuming that the BESS battery is fully charged at any given sunset, and not allowing for losses, (which are indeed significant, and will be required to be fully accounted for in any detailed analysis), the question is: how many homes can the battery supply during the 12 hours of the night?

In any proper analysis, proponents must show, to satisfy the latter part of the second claim above, that the BESS battery will be able to supply the full Demand, required by 262,000 homes, during the full night time period, including long winter nights. That’s the implied meaning of: “*The BESS will enable energy from solar to be stored and then released during times of demand.”*

Any detailed analysis must allow that the hours of darkness for each day vary throughout the year, being a minimum at the Summer Solstice and a maximum at the Winter Solstice (which incidentally, for 2024, has occurred just prior to the writing of this document). In considering the worst-case scenario, on winter nights, the night-time period is significantly longer than 12 hours, even in New South Wales at the latitude of the proposed location for the Birrawa facility.

For this analysis, I have presumed that the period to be considered commences on 1 January 2023, and ends at 10 June 2024, so that the initial nights, the period of darkness is close to the minimum for the Summer, so, for the purposes of the analysis, is favourable to the facility’s initial start state.

For generator data, I am using the real-time 5-minute generation data, publicly available from the AEMO, the operator of the Eastern Australian Grid, for the solar farm at Darlington Point New South Wales, which is listed by the AEMO as having an installed capacity of 245 MW. I have multiplied the output at each 5-minute data point by a factor of 2.182, (the multiplier being derived from the fact that as the stated capacity of the Birrawa solar generator is to be an installed capacity of 600 MW, then its output at any time, given that it is to be sited at a location not far distant from the Darlington Point facility in a similar climatic region, can be considered, to a first approximation, to be 600/285 times the output of the Darlington Point facility), and replaced it in the generator table.

The next step is, at each 5-minute timestep, to determine the Demand during that 5-minutes, resulting from 262,000 average Australian homes, in Zone 5 of the above table, each home comprising a 4-person household, these values varying as to the Season of the calendar year.

These Demand values are added to the generator table constructed above.

It is then a relatively simple matter to proceed to step through the table,

- determining the difference between the generator Supply and the Demand;
- adding (if a generation surplus) or subtracting (demand during the 5-minute period being greater than generator supply) the result from the current state of the BESS battery charge, terminating the process should the BESS battery charge state drop below 20-percent of rated capacity, or if not;
- repeating the preceding steps at the next 5-minute time step to re-run the calculation, until;
- the last 5-minute time step is processed, indicating that for the given time span, the solar generator plus BESS is able to satisfy the Demand imposed by 262,000 average Australian homes.

Limits: where the battery continues to discharge, the battery charge may not fall below 20-percent of the rated capacity (here 4000 MWh times 0.2 = 800 MWh), as such a state of discharge has a detrimental effect on battery lifetime. Where the battery charges, it may not charge to above 80-percent of full capacity, that is 3200 MWh. These then are the lower and upper limits of the battery's state of charge, (for the choice of these limits, see, for example, (Post, 2019).

**Results**

Commencing the run at 12:05 AM, that is, just after midnight on 1 January 2023, with an initial charge as the 80-percent limit, that is, 3200 MWh, the run terminated with the battery being discharged to its 20-percent limit at 2:05 AM on 2 January 2023.

This is a definitive result. A BESS of 4000 MWh capacity is incapable of supplying the Demand requirements of 262,000 homes for even 2 nights of the year 2023, at the height of the Summer months, when nights are shortest.

**Conclusion 1** The above analysis shows that the claim by the proponent that the solar "farm", presuming that it has an installed capacity of 600 MW, that it will supply 262,000 average homes, can best be described as wildly optimistic.

This massive failure requires a clear explanation from the proponent showing, in detail, how the calculations were performed and what assumptions were used, to arrive at a number of 262,000 average Australian homes served.

It is tempting to re-run the calculation, decreasing the number of households each time until, if possible, a value for the number of households might be reached where the process is able to step through the entire time period under consideration, that is: 1 January 2023 – 10 June 2024.

I did repeat the process and found that the 600 MW Solar Farm plus 4000MWh capacity BESS battery is able to support some 22,500 average Australian households, that is, some 11.64 times less than that claimed by the proponent, so of the order of 10-percent of the proponent's claim..

I also chose a Battery Storage value of 200,000 MWh, which is a very large battery, being in fact the equivalent of some 450 Geelong Big Batteries, but even with this amount of storage, the combined system, addressing the Demand of 262,000 average Australian homes, fell over at 2023/04/18 02:35:00, that is, after some 3 and a half months operation. Clearly, where even using a battery storage that is so large, so gargantuan, that it is completely unachievable, also fails, then the claim that the proposed solar farm will serve 262,000 homes is in the realms of fairyland.

It is clear from this last run that the required demand simply runs down the initial battery storage, that is, in attempting to supply 262,000 homes, the solar farm is unable to recharge the battery sufficiently to any extent at all.

**Conclusion 2** If the claim made by the proponent for the Birrawa Solar Project as to number of homes served is typical of the process being used generally by proponents of renewable energy projects that come before Planning NSW, then this analysis suggests that serious questions need to be asked about the assessment methods presently used, by both Planning NSW, and the Independent Planning Commission.

Yours faithfully,
Paul Miskelly
Moss Vale NSW
E: [redacted]

**References**

Round-trip battery efficiencies are mentioned in:
https://atb.nrel.gov/electricity/2023/utility-scale_battery_storage

Limits of Li-ion grid-scale battery charge/discharge:
Post, W 2023 *BATTERIES IN NEW ENGLAND TO COUNTERACT A ONE-DAY WIND/SOLAR LULL?* Available at:
https://www.windtaskforce.org/profiles/blogs/batteries-in-new-england

Post W *BATTERY SYSTEM CAPITAL COSTS, OPERATING COSTS, ENERGY LOSSES, AND AGING*. Available at:
https://www.windtaskforce.org/profiles/blogs/battery-system-capital-costs-losses-and-aging

Post W 2019 *THE HORNSDALE POWER RESERVE, LARGEST BATTERY SYSTEM IN AUSTRALIA*. Available at:
https://www.windtaskforce.org/profiles/blogs/the-hornsdale-power-reserve-largest-battery-system-in-australia

# The AEMO 2024 ISP Will Not Deliver Reliable Power

## AEMO's numbers just do not add up

A Report by Independent Engineers, Scientists and Professionals 31 July 2024

## *Introduction*

Our 9 February 2024 submission to AEMO and CSIRO concerning the *draft* ISP identified serious potential reliability problems resulting from AEMO's electricity grid design. Our inputs were largely ignored.

The final version of the ISP, released on 26 June 2024, essentially reveals the same deeply flawed model of the NEM electricity grid.

## *Failure to Address Clearly Stated Reliability Issues*

AEMO's ISP suffers from severe deficiencies in capacities of both energy storage and baseload back up power, starting in the next few years and lasting throughout the entire period to 2050. It shows no evidence of rigorous system design engineering required for high reliability systems based on worst case conditions and healthy reserve margins.

By 2030, the dispatchable reserve margin falls from historic levels in excess of plus 20% to minus 19% and in subsequent years it is substantially worse. It cannot deliver adequate power when NEM-wide grid demand is maximum and when overnight solar is zero and wind output is close to nothing.

Furthermore, the negative reserve margin provides no allowance for facility outages for maintenance and repairs. The grid design also suffers from insufficient power capacity to quickly recharge the energy storages to prepare for the next set of worst case conditions.

AEMO's own historical NEM data demonstrates periods of very low renewable energy production lasting 3 or more consecutive days and dramatic falls occur many times in a month. Periods of several months, when wind and solar outputs are well below long term averages, are evident in both Australian and overseas data. May 2024 witnessed several major droughts.

The energy storage capacity in the ISP is too low by at least a factor of ten. Adding more batteries and additional renewable generation to recharge them is completely unaffordable.

## *Deceptive Data Concerning Dispatchable Power*

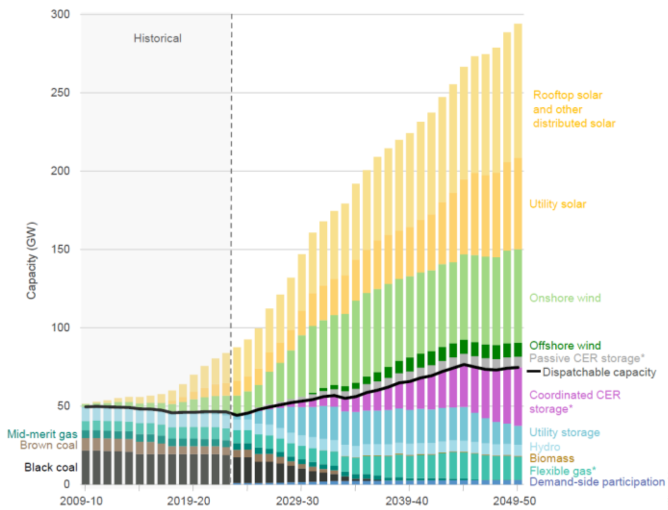
Figure 2 in the ISP is a graphical chart showing power from various generation sources and storages by year until 2050 (see next page).

It shows impressive growth to 2050 but almost all growth is in renewables which have very low capacity factors (25-32%). Similarly, energy storage outputs show remarkable growth but most of these provide power for just a few hours. Much it is from coordinated home resources which may be uncertain. The dispatchable black line climbs to above 75 GW by 2050 but in truth, it is meaningless because much of it cannot be used to back up the grid when solar and wind power are largely absent for periods of multiple days and significantly below average for periods of months.

This deceptive portrayal is merely a summation of maximum power outputs from all sources. A truthful depiction would, as a minimum include warnings to the effect that renewables provide less than one third of maximum power on average and not all dispatchable power provides practical levels for grid back up.

Figure 2.4 in our submission (see below) provided an alternative version of this chart showing the true dispatchable power over various periods based on ISP data for energy storages (ISP Figure 20). By 2040, the dispatchable power of AEMO's ISP design falls to just 30 GW for backup durations of one week but at the same time it indicates that for 16 hours overnight, it is only 37 GW. However, a proper engineering design with a 20% dispatchable reserve margin will require over 60 GW by 2040.

Figure 2 Capacity, NEM (GW, 2009-10 to 2049-50, Step Change)



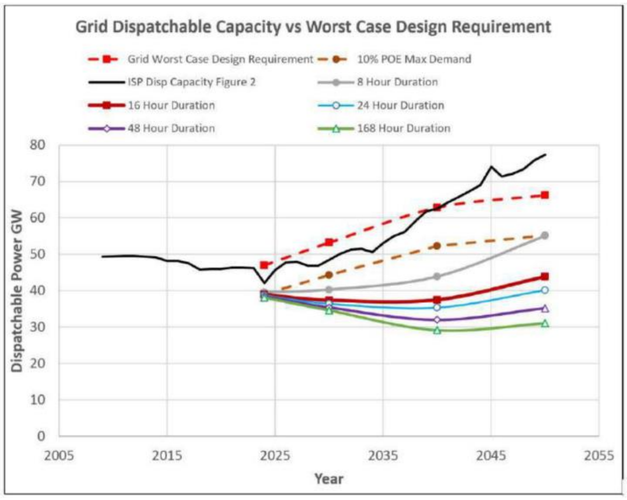




Figure 2.4 Dispatchable Power Capacity vs Grid Design as a Function of Duration

## *A Whole-of-System Power Budget Shows Failure of Reliable Power at Night*

A whole-of-system power budget is fundamental to understanding the viability of the AEMO ISP and making a counterpoint to the CSIRO GenCost report, however, the ISP provides no system level power budget data. In fact, the ISP does not contain any data on maximum demand. Instead it forecasts average annual energy production figures. This is no way to design a high reliability system.

Proper high reliability engineering design requires use of worst case conditions plus a margin for facility outages for maintenance and repairs. A whole-of-system power budget table (on the next page) is based entirely on AEMO's ISP data.

Our power budget uses maximum grid demand data from the August 2023 AEMO ESOO report because the ESOO update of March 2024 did not contain this data.

We show that by 2030, the dispatchable reserve margin falls to minus 19% on a single 16 hour overnight period when solar is zero and wind falls very close to zero. Any facility outages for maintenance or repairs will make this figure worse. There is simply not enough baseload power nor energy storage capacity.

To restore the dispatchable reserve margin to at least plus 20% would require an additional 17.4 GW of baseload or stored energy outputs in 2030, rising to 28.1 GW in 2040 and 2050.

In the event of multiple day wind and solar drought conditions, there is not sufficient surplus power during daytime to completely recharge expanded energy storages sufficient to handle another overnight period under worst case conditions.

Blackouts are inevitable. The AEMO ISP cannot deliver reliable power under worst case conditions. This is not a matter requiring fine tuning of the grid design. It is a massive failure.

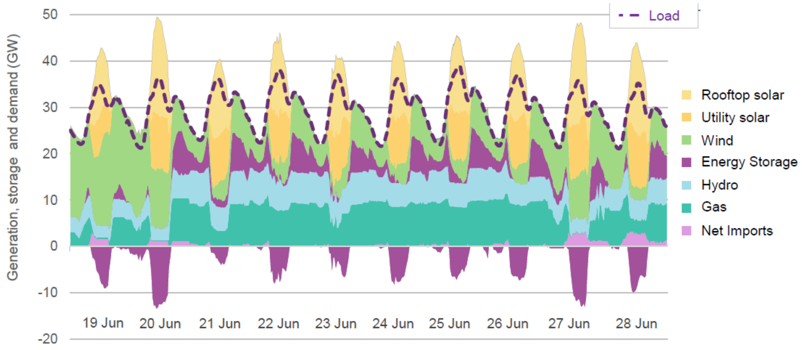
| 2024 FINAL ISP Top-Down Whole-of-System Power Budgets | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AEMO NEM Grid Design per 2024 FINAL ISP** | | | | | | | | | | | | | | |
| **Worst Case & 20% Reserve Margin** | | | **2024-25** | | | **2029-30** | | | **2039-40** | | | **2049-50** | | |
| 24 hr Top-level Whole-of-System Power Budget | | | **Capacity** | **Night** | **Daytime** | **Capacity** | **Night** | **Daytime** | **Capacity** | **Night** | **Daytime** | **Capacity** | **Night** | **Daytime** |
| **Duration hours** | | | | 16 | 8 | | 16 | 8 | | 16 | 8 | | 16 | 8 |
| **NEM Power Demand** | | | | **GW** | **GW** | | **GW** | **GW** | | **GW** | **GW** | | **GW** | **GW** |
| 10% POE Max Demand (ESOO 2023) | | | | 39.1 | 39.1 | | 44.3 | 44.3 | | 52.3 | 52.3 | | 55.2 | 55.2 |
| Dispatchable Reserve Margin | 20% | | | 7.8 | 7.8 | | 8.9 | 8.9 | | 10.5 | 10.5 | | 11.0 | 11.0 |
| **Total Power Design Requirement** | | | | **47.0** | **47.0** | | **53.2** | **53.2** | | **62.8** | **62.8** | | **66.2** | **66.2** |
| **Power Sources** (Fig 2 2024 ISP) | **Capacity Factors** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | |
| **Baseload Power** | **Night** | **Daytime** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** |
| Coal - Black & Brown | 100% | 100% | 21.2 | 21.2 | 21.2 | 11.44 | 11.4 | 11.4 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Gas - Mid Merit & Flex | 100% | 100% | 12.54 | 12.5 | 12.5 | 11.62 | 11.6 | 11.6 | 15.89 | 15.9 | 15.9 | 15.0 | 15.0 | 15.0 |
| Hydro | 100% | 100% | 6.84 | 6.8 | 6.8 | 6.84 | 6.8 | 6.8 | 7.14 | 7.1 | 7.1 | 7.07 | 7.1 | 7.1 |
| Biomass | 100% | 100% | 0 | | | 0 | | | 0.45 | | | 0.45 | | |
| DSP | 100% | 100% | 0.95 | | | 1.64 | | | 2.5 | | | 2.90 | | |
| **Total Baseload Dispatchable** | | | **40.6** | **40.6** | **40.6** | **29.9** | **29.9** | **29.9** | **23.0** | **23.0** | **23.0** | **22.1** | **22.1** | **22.1** |
| **Energy Storage** Fig 20 2024 ISP) | | | **GWh** | | | **GWh** | | | **GWh** | | | **GWh** | | |
| Snowy 2.0 + Borumba | | | 0.0 | | | 349.80 | | | 397.75 | | | 397.75 | | |
| Deep | | | 6.27 | | | 6.27 | | | 42.10 | | | 77.81 | | |
| Medium, Shallow, Coord CER | | | 12.27 | | | 55.27 | | | 102.30 | | | 170.42 | | |
| **Total Storage Capacity** | | | **18.5** | | | **411.3** | | | **542.2** | | | **646.0** | | |
| | | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | |
| **Storage Max Power Capacity** | | | **GW max** | **GW** | **GW** | **GW max** | **GW** | **GW** | **GW max** | **GW** | **GW** | **GW max** | **GW** | **GW** |
| Snowy 2.0 + Borumba | | | 0.0 | 0.0 | 0.0 | 2.2 | 2.2 | 2.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 |
| Deep (limited by max power output) | | | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 1.1 | 1.1 | 1.1 | 1.3 | 1.3 | 1.3 |
| Medium, Shallow, Coord CER (avg output overnight) | | | 3.9 | 0.8 | 0.0 | 14.0 | 3.5 | 0.0 | 31.5 | 6.4 | 0.0 | 44.7 | 10.7 | 0.0 |
| **Total Max Storage Power** | | | **4.1** | | | **16.4** | | | **36.8** | | | **50.2** | | |
| **Avail. Storage Power Dispatchable** | | | | **1.0** | **0.2** | | **5.9** | **2.4** | | **11.7** | **5.3** | | **16.2** | **5.5** |
| **Total Dispatchable Power** | | | | **41.5** | **40.8** | | **35.8** | **32.3** | | **34.7** | **28.3** | | **38.2** | **27.6** |
| **Surplus/Deficit(-) wrt 10% POE Demand** | | | | **2.4** | **1.6** | | **-8.5** | **-12.0** | | **-17.6** | **-24.0** | | **-17.0** | **-27.6** |
| **Dispatchable Reserve Margin** | | | | 6.2% | 4.2% | | -19.3% | -27.1% | | -33.6% | -45.8% | | -30.8% | -50.1% |
| | | | | | | | | | | | | | | |
| **VRE Renewables** (Fig 2 2024 ISP) | **Capacity Factors** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | | **Capacity** | **Delivered** | |
| | **Night** | **Daytime** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** |
| Wind: Onshore | 0% | 0% | 13.0 | 0.0 | 0.0 | 39.26 | 0.0 | 0.0 | 51.87 | 0.0 | 0.0 | 59.53 | 0.0 | 0.0 |
| Wind - Offshore | 0% | 0% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 |
| Solar Utility | 0% | 0% | 9.5 | 0.0 | 0.0 | 15.58 | 0.0 | 0.0 | 31.17 | 0.0 | 0.0 | 58.26 | 0.0 | 0.0 |
| Solar Distributed VPP | 0% | 0% | 23.48 | 0.0 | 0.0 | 36.06 | 0.0 | 0.0 | 60.16 | 0.0 | 0.0 | 85.74 | 0.0 | 0.0 |
| **Non-dispatchable VRE** | | | **46.0** | **0.0** | **0.0** | **90.9** | **0.0** | **0.0** | **152.2** | **0.0** | **0.0** | **212.5** | **0.0** | **0.0** |
| **Total Dispatchable + VRE Power** | | | | **41.5** | **40.8** | | **35.8** | **32.3** | | **34.7** | **28.3** | | **38.2** | **27.6** |
| **Surplus/Deficit(-) wrt 10% POE Demand** | | | | **2.4** | **1.6** | | **-8.5** | **-12.0** | | **-17.6** | **-24.0** | | **-17.0** | **-27.6** |
| | **Efficiency** | | | | **GW** | | | **GW** | | | **GW** | | | **GW** |
| **Req'd Daytime Recharge Power** | **80%** | | | | **2.4** | | | **14.6** | | | **29.2** | | | **40.4** |
| **Avail. NEM Daytime Recharge** | | | | | **1.4** | | | **-14.4** | | | **-29.3** | | | **-33.1** |
| **Recharge Power Surplus/Deficit(-)** | | | | | **-1.0** | | | **-29.0** | | | **-58.5** | | | **-73.5** |

## *AEMO's Attempt to Demonstrate System Reliability is Misleading*

In Section 6.5 "Reliability and security in a system dominated by renewables", the ISP acknowledges the challenge as renewables approach 100% of generation. But it claims: "*Consumers should be confident that the NEM's mix of technologies will keep electricity supply secure and reliable during normal operation, extreme peak demand and renewable droughts*."

In the ISP, Figure 24 (p72) attempts to illustrate operability through an eight-day renewable drought for the "NEM except Queensland". ISP Appendix 4 (Figure 15 p 26) reveals that this simulation test involved an "extended VRE drought event running from 21 June 2040 to 28 June 2040 (reflective of conditions observed historically in June 2019)."

Figure 24 Operability through eight-day renewable drought, NEM except Queensland




This one-off test looks impressive but is merely an illustration far short of what a proper statistical engineering analysis would require. A detailed examination of the data behind this test revealed the following:

1. It assumes imports of power from QLD yet represents a partial system.
2. It assumes maximum power continuously from all dispatchable resources.
3. It assumes extreme VRE drought conditions were for 6 days not 8.
4. It assumes wind capacity factor was 10% in daytime; 13% overnight – not worst case.
5. It assumes solar capacity factor was 13-15% - not worst case.
6. Non-daytime grid demand in early evening was 32 GW decreasing by 31% after midnight to 22 GW; this profile is speculative in the face of increasing EV demand for overnight charging; worst case is a flat maximum demand.
7. The ISP admits that "reliability risk would be elevated, particularly if major generator or transmission outages occur" i.e. no facility outages were taken into account.

These are certainly NOT rigorous worst-case conditions. Instead of illustrating the reliability of the NEM grid design, this test indicates the extent to which the AEMO ISP misrepresents its viability.

## *Conclusions*

Despite its impressive appearance, the ISP contains fundamental technical drawbacks. From an engineering perspective, the AEMO ISP is seriously flawed and fails to provide assurance that the NEM grid design has been developed in accordance with modern system engineering principles for high reliability systems.

We therefore conclude the AEMO ISP, which underpins the entire national economy, will not serve Australian consumers and businesses with reliable electrical power. It is clear this plan has been driven by changes to National Electricity Rules by non-technical politicians and bureaucrats to set artificial goals for renewables divorced from engineering realities.

It is critically important and urgent that an ongoing review process be implemented with advice and input by independent experts to oversee AEMO and CSIRO work on the future NEM.

## *Independent Engineers, Scientists and Professionals*

This report has been prepared and supported by independent engineers, scientists and professionals who have many decades of relevant experience and requisite qualifications without any monetary conditions, employment or conflicting interests.

William Bourke, BSc, BEng (Aero), MEng Sc.
Ben Beattie, BE(Elec), CPEng RPEQ
Michael Bowden IEng (Electronics-UK); CPL; CQP
Rafe Champion, M.Sc (History and Philosophy of Science), B.Ag.Sc. (Hons)
Paul R C Goard, B.Sc, Physicist, M.A.I.P., M.I.of P., M.A.I.E., M.A.M.O.S.
Peter J F Harris, BEng, Dipl. Prod Eng.
Professor Emeritus Aynsley Kellow, BA(Hons) PhD
John McBratney, B. Tech (Electronic Engineering), formerly MIE Aust, MIEEE
Paul McFadyen, BSc, MSc, PhD
Emeritus Professor Cliff Ollier, DSc
John McLean, PhD
James R (Jim) Simpson, (Ret., former business unit manager, OTC & Telstra)
Walter Starck PhD (Marine Science)
James Taylor, PhD, MSc, BEng Elect (Hon), PEng, FCASI
Lawrence A P Wilson, D.App.Chem, D.Chem.Eng, B.Comm (Economics)

Corresponding Author: james.taylor861@gmail.com

**From:** [redacted]
**To:** IPCN Enquiries Mailbox
**Cc:** [redacted]
**Subject:** Attached Submissions against the Wallaroo Solar Farm Moving Forward on behalf of the Yass Landscape Guardians Inc.
**Date:** Wednesday, 31 July 2024 10:47:45 PM
**Attachments:** YLG Wallaroo IPC Submission Letter Head Connection Capacity.docx
YLG Wallaroo IPC Submission Letter Head Contamination.docx
YLG Wallaroo IPC Submission Letter Head Farm Land.docx
YLG Wallaroo IPC Submission Letter Head Fire.docx
YLG Wallaroo IPC Submission Letter Head Lack of Decommissioning Legislation.docx
YLG Wallaroo IPC Submission Letter Head Liability Insurance.docx

---

Dear IPC
On behalf of the Yass Landscape Guardians Inc. Please find attached submissions against the Wallaroo Solar Farm moving forward.
Tomorrow I will forward copies of all my submissions, including these on behalf of the Yass Landscape Guardians Inc. to both Federal and NSW State Members of parliament and Senators
Best regards John McGrath
Secretary Yass Landscape Guardians Inc

**From:** [redacted]
**To:** IPCN Enquiries Mailbox
**Cc:** [redacted]
**Subject:** Questioning the allegded households serviced by renewable energy generators
**Date:** Wednesday, 31 July 2024 11:09:43 PM
**Attachments:** 240705 - Letter to Minister Scully re Number of Households Served Claims (2).pdf
240705 - Letter to Minister Scully re Number of Households Served Claims (2).pdf

---

Hello IPC
On behalf of Yass Landscape Guardians Inc.,
Whilst, I am aware that the claims made by renewable energy project proponents are misleading, I haven't taken on the task of working out the load of an average home and dividing it into the claimed homes supplied?
Therefore with relevance to the Wallaroo Solar Farm as a submission from Yass Landscape Guardians Inc.please find attached a letter from Paul MisKelly to Minister Scully who has done the maths as attached. I hope that the Wallaroo Solar Farm IPC take this letter on board and further query the proponent for the Wallaroo Solar Farm, who did not appear to have the answers on the 18th July 2024 to respond to the presentations at the Wallaroo Solar Farm IPC as to really how many homes their installation can supply?
FYI tomorrow I will also forward this email on to all Federal and NSW State Politicians.
Best regards
John McGrath
Secretary Yass Landscape Guardians Inc.

# The Missing Whole-of-System Cost Model in the AEMO 2024 ISP

## The Real Cost of the NEM Transition

A Report by Independent Engineers, Scientists and Professionals 31 July 2024

## *Summary*

The government has not provided a true estimate of cost for AEMO's plan to transition the NEM to intermittent wind & solar, yet it claims adding reliable nuclear and gas power generation is too costly.

AEMO published its 2024 Integrated System Plan (ISP) in June. It contains only one paragraph[1] to indicate annualised capital costs as either $122 billion present value or $142 billion upfront present value, not including "commissioned, committed or anticipated projects, consumer energy resources, or distribution network upgrades". This unrealistic, poorly defined estimate needs much clarification.

The whole-of-system analysis in this report, draws on 2024 ISP capacities for generation and storages and CSIRO 2024 GenCost cost factors[2], and shows total capital costs for the 2024 ISP over one trillion dollars for a system unable to deliver reliable power[3]. This is about twice the capital costs of four alternative grid designs using gas, coal and nuclear. When fuel costs for gas and coal are considered, nuclear plus gas designs are likely to be the least costly of all options.

## *A More Comprehensive Capital Cost Analysis*

The whole-of-system cost charts in Figure 1 below provide both total capital and present value for a more comprehensive model of the planned NEM grid transition, showing a present value more than four times higher than the 2024 ISP figures. Estimates include both CSIRO's somewhat optimistic declining future capital cost factors and its flat 2024 cost factors to reflect uncertainties in forecasting. The Baseline 2024 ISP estimates include all generation and storage costs including consumer energy resources, transmission lines, distribution network upgrades and other support costs to reflect the total costs to the economy.

Extending the Baseline ISP with additional gas or storage to overcome the major unreliability of the ISP's design incurs extra costs and makes clear that 'firmed renewables with batteries' is unaffordable. Four alternative designs using gas, coal and nuclear provide comparisons. The results, based on AEMO and CSIRO data, show that the present transition plan is the most costly approach by a large margin.

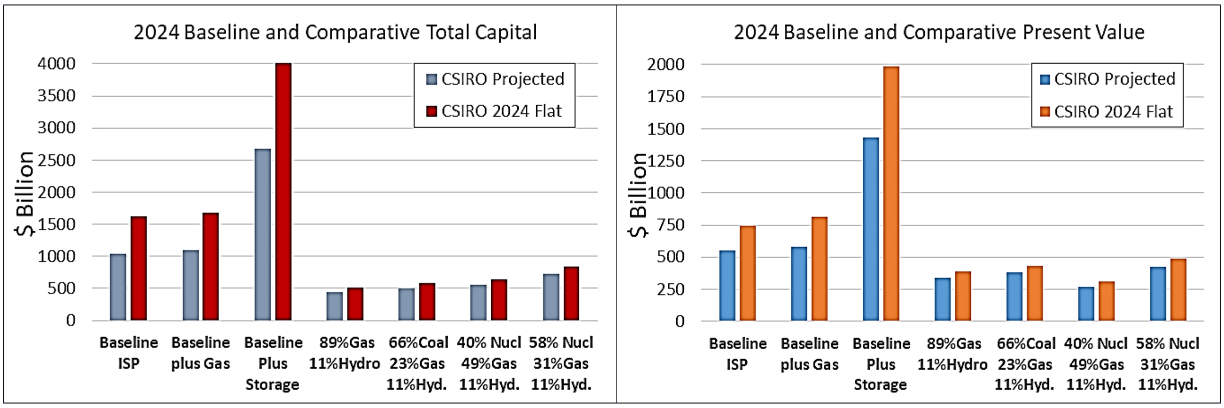



Figure 1 AEMO 2024 ISP Baseline and Comparative Whole-of-System Capital Costs in 2024 dollars

[1] AEMO 2024 Integrated System Plan Page 74

[2] ISP Figures 2 and 20; GenCost Section 4.3;

[3] The 2024 AEMO ISP Will Not Deliver Reliable Power, Independent Engineers, Scientists and Professionals, 19 July 2024

## *Conclusions*

1. Our analysis uses a proper high reliability systems engineering approach to assess a 24-hour cycle under worst-case conditions of maximum demand, wind and solar droughts and the need for a minimum 20% dispatchable reserve margin (DRM)[4] to guard against facility outages. A whole-of-system 'Baseline' power budget using 2024 ISP capacities shows the DRM at minus 19% by 2030 and falling much lower by 2040. Widespread and frequent blackouts are certain.
2. Adding battery storages and extra wind & solar to recharge them ('firmed renewables') to achieve 20% DRM overnight results in completely unaffordable total capital costs of several trillion dollars and provides storage for just one 16-hour overnight period. And it still leaves daytime DRM massively negative. Battery storage capacity for one week requires $5-7 trillion. Replacements every decade would cost upwards of $3.5 trillion. This is simply not a viable path.
3. Alternatively, adding gas to existing hydro to essentially duplicate the grid when wind and solar are in drought requires a not-insignificant additional capital cost of $30-60 billion. It would provide continuous backup capability, day and night, but its low utilisation rates would make its economics unattractive for investors.
4. The four alternative grid designs, 89% gas plus hydro, 66% coal plus gas & hydro, 40% nuclear plus gas & hydro, and 58% nuclear plus gas & hydro, provide reliable 24/7 power with less than about half the capital costs. The nuclear options, with lifetimes up to 80 years lasting far beyond 2050 compared with wind and solar, minimise costs for gas and probably reduce emissions to less than the Baseline ISP, once whole-of-life emissions for mining, processing and manufacturing of almost 900 times more material is taken into account. All four alternatives impose a tiny environmental footprint compared to the 1.6 million hectares for Baseline ISP wind & solar.
5. It is clear that contrary to continual claims that wind & solar are the cheapest form of electricity generation, it is in fact the most expensive when proper whole-of-system estimates are made. The present plan for transition of the NEM is disastrous in terms of reliability, cost to the economy and in particular to the environment, without being a path to the lowest emissions.
6. The alternative cost models assume wind & solar installations taper off after 2030. At additional cost, a small level of wind & solar (15-20%) can be maintained in the long term grid design.

## *Recommendations*

1. A thorough investigation by independent authorities and immediate implementation of effective accountability mechanisms must be implemented to counter the complete failure of public energy policy regarding reliability and energy costs based on misleading information from public institutions.
2. The AEMO ISP and CSIRO GenCost documents must be subjected to higher genuine standards for truthfulness, completeness and professional engineering processes in place of slavishly following flawed existing policies.
3. Embedding wind & solar targets into the National Electricity Rules must be halted to end the replacement of power systems engineers by politicians and government bureaucrats selecting technological design solutions without proper engineering qualifications.
4. Independent expertise for frequent technical and financial review must be employed in new accountability processes at multiple levels and points in time with a mandate to examine and openly examine a wide range of technological approaches.
5. The AEMO 2024 ISP must be discarded and an immediate start be made on a new energy NEM plan considering all power system technologies.

[4] DRM is the sum of baseload power over maximum demand. In 2019 the DRM was plus 20% (AER)

## *Independent Engineers, Scientists and Professionals*

This report has been prepared and supported by independent engineers, scientists and professionals who have many decades of relevant experience and requisite qualifications without any monetary conditions, employment or conflicting interests.

William Bourke, BSc, BEng (Aero), MEng Sc.
Ben Beattie, BE(Elec), CPEng RPEQ
Michael Bowden IEng (Electronics-UK); CPL; CQP
Rafe Champion, M.Sc (History and Philosophy of Science), B.Ag.Sc. (Hons)
Paul R C Goard, B.Sc, Physicist, M.A.I.P., M.I.of P., M.A.I.E., M.A.M.O.S.
Peter J F Harris, BEng, Dipl. Prod Eng.
Professor Emeritus Aynsley Kellow, BA(Hons) PhD
John McBratney, B. Tech (Electronic Engineering), formerly MIE Aust, MIEEE
Paul McFadyen, BSc, MSc, PhD
Emeritus Professor Cliff Ollier, DSc
John McLean, PhD
James R (Jim) Simpson, (Ret., former business unit manager, OTC & Telstra)
Walter Starck PhD (Marine Science)
James Taylor, PhD, MSc, BEng Elect (Hon), PEng, FCASI
Lawrence A P Wilson, D.App.Chem, D.Chem.Eng, B.Comm (Economics)

Corresponding Author: [redacted]

## Appendices

A Estimation Methodology

B Cost Model Notes

## Appendix A Estimation Methodology

A. The AEMO 2024 ISP provides the data (Figures 2 and 20) regarding total NEM capacities of all generation (GW) and energy storages (GWh) in 2024-25, 2029-30, 2039-40 and 2049-30.

B. The CSIRO 2024 GenCost report (Section 4.3) provides projected capital cost factor data (in 2024 dollars) for various energy technologies. This data excludes of all subsidies, offsets and tax breaks, which nevertheless have to be paid by all consumers in one form or another.

C. Since the projected cost factors are largely declining and are based on forecasts which contains substantial uncertainties, a second estimate using flat CSIRO 2024 cost factors provides higher cost estimates reflecting potential upsides.

D. A power budget for each grid design model is based on a 24-hour cycle broken into 8 hours centred on midday when solar is available and 16 hours overnight when solar is essentially zero. The DRM is the surplus/deficit of the sum of baseload power over peak demand in each of the 8 and 16 hour periods. Stored energy is used only during overnight periods to contribute to dispatchable power; recharging takes place in daytime when solar is expected to be available but is also subject to weather conditions causing low outputs.

E. Except for the Baseline 2024 ISP model using only the capacities specified in the ISP, the capacity data for other models is adjusted to achieve a DRM in each period and year of at least plus 20% to ensure reliability in the face of facility outages.

F. The capital costs of Snowy 2.0 and Borumba pumped hydro facilities are taken from current government announcements. Costs of passive storages behind the meter are included because they lower demand while making no direct input to the grid.

G. The capital costs prior to 2024-25 are estimated using the 2024-25 ISP capacities and CSIRO 2024 cost factors.

H. The capital costs for each of three periods, 2024-30, 2030-40 and 2040-50 are estimated as the sum of the various generation capacities installed in each period plus the replacement for past installations that have exceeded lifetimes valued by the cost assumption for the mid-point of each period.

I. The modelled lifetimes are 10 years for batteries, 20 years for wind and solar, 30 years for gas, 50 years for coal and 80 years for pumped hydro and nuclear.

J. Costs for existing hydro facilities were not included in any models due to lack of data. Costs for existing coal plants were not included since they are near end-of-life and being retired.

K. The present value estimate is derived by applying a 7% per annum pre-tax, real discount rate applied to capital expressed in 2024 dollars in three periods: 2024-30, 2031-40 and 2041-50 at mid points.

L. The demand side participation (DSP) capacity derived by the 2024 ISP is not used since it is clearly not a source of power but rather a reduction in demand brought about by time-of-use tariffs and central controls to impose rationing on consumers. i.e. this misguided policy attempts to make customers serve a deficient grid design rather than the grid delivering power to consumers as and when required.

M. NEM peak demand is defined by AEMO's 2023 ESOO report for 10% Probability of Exceedance (POE) loads based on detailed forecasting. Note: peak demand will exceed this value about 36 days per year, reinforcing the need for a healthy DRM.

N. The AEMO ISP's use of daily demand profiles to demonstrate grid performance is rejected for use in high reliability system design, which requires worst case conditions. The advent of EV recharging overnight will flatten future demand profiles (according to the 2022 ISP and supported by surveys which show most EV owners prefer/require overnight charging). Incentives (punishing tariffs) to recharge during daytime when solar power is often in surplus is highly problematic and unlikely to gain social licence. Worst case system design must use a flat peak demand. The 10% POE peak demand definition is further support for a conservative approach to worst case conditions.

O. Other costs applied to all models include transmission lines, low voltage distribution networks, grid stabilisation facilities, land acquisition for transmission lines (land costs are included in Gencost cost factors for generators), and an allowance for disposal, recycling and remediation.

P. While the accuracy of this whole-of-system cost estimation methodology is not precise, neither are all future model projections, which inevitably contain considerable uncertainty. However, we apply the same methodology to all seven case models, thus making relative accuracy among them better than absolute accuracy.

## Appendix B Cost Model Notes

### Baseline 20024 ISP Model Case

The Baseline ISP 2024 grid design contains severe deficiencies in both baseload power and energy storage capacity causing the DRM by 2030 to be minus 10% instead the desired plus 20% – a shortage of 30% in dispatchable power. For 2040 and 2050, the shortages exceed 60%.

Such a design could only be based on hopes that weather conditions will always enable 'some power' to be produced in 'some parts' of the grid to be delivered to the rest of the NEM by an extensive network of transmission lines. However, AEMO's historical power supply data[5] tells a different story of frequent periods, often on windless nights, when NEM available solar and wind power capacity factors fall close to zero. Some drought periods can last for more than three days and repeated episodes can often occur with only short intervals in between. Prolonged months-long spells can cause average renewable capacity factors well below expectations.

The AEMO 2024 ISP is a deeply flawed grid design which cannot deliver reliable power – blackouts are inevitable.

The cost of transmission network upgrades is based on the 2024 ISP plan to install 10,000 km of new transmission lines. Costs are estimated to be $1.3 to 2.0 million per km and subject to escalation. Significantly less transmission line costs are required for the four alternative cases.

The 2024 ISP "…assumes upgrades and other investments needed to enable distribution networks….will occur through other mechanisms…". This study makes an estimate for distribution network upgrade costs of about 5-10 thousand dollars per house based on expert opinion[6]. Much of this cost becomes unnecessary for the four alternative cases.

Stabilisation facilities such as synchronous condensers (costing $10-20 million each) will increasingly be required as baseload plants with rotating machinery are retired in favour of systems using electronic inverters. However, as with the transmission and distribution network costs, much of this is unnecessary for the four alternative cases.

Land acquisition costs for transmission lines are estimated from $200K-230K per km and are a subject of considerable debate in project approval hearings, where social licence is in short supply.

There is little information on projected costs for disposal, recycling and land remediation as a result of very substantial materials from expired wind turbines, solar panels and batteries. A nominal figure of $1-2 billion per year in future is used as large volumes of required replacements build up in the Baseline ISP case.

### Baseline Plus Additional Gas Generation Case

The 2024 ISP phases out coal generation by 2037 and replaces CCGT (merit) gas plants with OCGT (flex) gas plants (designed to some day burn hydrogen, if or when available). To restore a plus 20% DRM, this Case adds much additional gas generation, starting in 2030, to almost quadruple the planned level by 2050. The daytime period is most critical since the minimal 2024 ISP storages will be depleted overnight and are primarily intended to handle short peak demands and transients.

[5] Independent Engineers , Scientists & Professionals, Submission to AEMO CSIRO Draft 2024 ISP GenCost 9Feb2024, P18-20

[6] Electric Power Consulting Submission on the 2024 Draft AEMO Integrated System Plan

Maximum gas generation, hydro and biomass baseload provide a 20% reserve margin indefinitely during daytimes which rises well above 20% combined with storages at night. At night, gas generation would probably be lowered to reduce emissions but also at the cost of reducing the capacity factors of gas plants and their economic efficiency.

One implication of this case is the need to assure domestic gas supplies and deliver infrastructure are sufficient.

Costs for transmission lines and other elements remain as for the baseline case.

Table 1 provides a summary of key power system demand and DRM.

| | **2029-30** | | **2039-40** | | **2049-50** | |
|---|---|---|---|---|---|---|
| | **Night** | **Day** | **Night** | **Day** | **Night** | **Day** |
| | **GW** | **GW** | **GW** | **GW** | **GW** | **GW** |
| Peak Demand | 44.3 | 44.3 | 52.3 | 52.3 | 55.2 | 55.2 |
| Baseload Power | 53.2 | 53.2 | 62.5 | 62.5 | 66.5 | 66.5 |
| Storage Power | 5.9 | | 10.8 | | 16.2 | |
| Dispatchable Reserve Margin % | 33.3 | 20.0 | 40.1 | 19.5 | 49.7 | 20.5 |

Table 1 Baseline Plus Gas Generation Case

### Baseline Plus Additional Storage and Wind & Solar Case

This Case leaves gas generation the same as in the Baseline Case and retires coal generation in the 2030s. A massive addition of extra utility battery storage of almost six times the level in the 2024 ISP by 2050, is required to achieve a DRM above 20% to protect against a worst case wind & solar drought on windless nights. And this also requires a corresponding massive increase in wind & solar to recharge them.

Even this large storage capacity would only cover a single night under worst case conditions.

The capital cost is estimated at $2.6-3.9 trillion. Since the marginal cost of adding batteries is $485 billion per day, a grid system with a seven day battery storage capacity would have a total capital cost of $5-7 trillion, even without adding more renewable recharge capability. The 10 year life of batteries also incurs massive ongoing replacement costs on the order of $3.5 trillion per decade.

Moreover, two further interrelated problems need addressing. The DRM during daytime – absent storage outputs – is disastrously below minus 50% so that there is no means to recharge the large battery capacity in the event of a wind & solar drought.

The reality is a reliance on a minimum level of at least 10% capacity factor for all wind and solar generation. This is not a real solution for DRM since wind & solar are not dispatchable.

In view of these estimates, this Case, widely touted as “firmed wind & solar with big batteries”, is simply neither technically viable nor economically affordable.

### An 89% Gas Powered Grid Case

This Case follows on from the Baseline plus added gas Case. Capital cost is minimised by keeping the same gas generation, which together with hydro can indefinitely provide the plus 20% DRM both night and day. By halting further rollout of both wind & solar and battery storage after 2030, major capital cost savings are obtained as a trade-off against a lower reduction of operating emissions.

However, it should be noted that gas generation has about half the emissions of the present coal-based grid. The Case also avoids the substantial emissions involved in mining, processing and manufacturing of all of the materials required for wind turbines, solar panels and batteries and their frequent replacements. The amount of such materials has been estimated at about 700-900 times the materials needed for a typical baseload power plant. Therefore, the net increase in emissions of this Case may not be substantial.

Further, the very small environmental footprint of this alternative is negligible compared to wind and solar farms and is therefore another factor for consideration.

Another significant benefit is that gas and hydro facilities will run at higher capacity factors providing more attractive returns for investors, thus providing greater market stability and improving national productivity.

A detailed analysis is needed of the trade-off (Trade Off Analysis) in this Case between the lower capital costs and the postulated emissions reductions offset by the increased Renewable Materials Costs and other environmental benefits.

**A 66/23% Coal/Gas Grid Case**

This Case is a continuation of using coal generation and its expansion. Instead of retiring existing coal plants, they are replaced and expanded to double the present capacity by 2050. As for the previous Case, wind & solar and storage rollouts are halted after 2030.

While limited emission reductions are evident in this Case, potential exists for using advanced coal plant technology to improve efficiency. Carbon capture is not part of this model. However, benefits include the avoidance of renewable facility costs, a negligible environmental footprint and reduction of substantial emissions from mining, processing and manufacture of wind & solar.

As for the 89% Gas Powered grid Case, another significant benefit is that coal, gas and hydro facilities will run at higher capacity factors providing more attractive returns for investors, thus providing greater market stability and improving national productivity.

Again, a Trade-off Analysis is required for the Case.

**A 40/49% Nuclear/Gas Grid Case**

For this alternative, the GenCost 2024 cost assumption for large scale nuclear power plants is used. Ongoing product development of SMR systems is proceeding briskly at multiple companies including Rolls Royce (the manufacturer of the planned AUKUS submarine reactors). SMRs offer a vision of production line manufacturing efficiencies for standard products, which will be approved by multiple countries as are commercial jetliners, thus simplifying and shortening the approval process. It will be several years before SMR products are sufficiently mature to be able to assess their true cost factors. This has not prevented many countries from already placing orders for SMRs.

Nuclear fission power plant technologies have a 70 year history of increasing safety, maturity, minimal environmental impact and zero operating emissions, which provides an attractive option.

This Case posits a blend of gas (for fast reaction to load variations and grid transients) and nuclear power generation. The 2024 GenCost 2024 capital cost assumption for large scale nuclear plants can be favourably compared with other generation technologies when adjusted for estimated lifetimes as indicated in Table 2.

From this comparison, a nuclear power plant is effectively much more competitive than the GenCost 2024 results would indicate.

| | Nuclear | Gas | Solar | Onshore Wind | Offshore Wind |
|---|---|---|---|---|---|
| Lifetime Years | 80 | 30 | 20 | 20 | 20 |
| GenCost 2024 Cost Assumption $B/GW | 8.5 | 1.3 | 1.4 | 3.0 | 6.7 |
| Lifetime Adjusted Nuclear Cost Assumption $B/GW | 8.5 | 3.2 | 2.1 | 2.1 | 2.1 |

Table 2 Equivalent Nuclear Capital Cost Factor Adjusted for Lifetime

In this Case, rollout of wind & solar and storages are halted after 2030 because nuclear and gas baseload generation can run continuously, thus avoiding further capital costs. As its capital cost is much higher than gas plants, nuclear plant should be run continuously at high utilisation rates to achieve the lowest unit cost since the fuel cost per KWh is much cheaper than gas. The gas component provides an ability to quickly ramp up and down to compensate for variable load demands.

Since nuclear plant installation is unlikely to commence before mid-2030s, it is vital that new gas generation facilities be launched as soon as possible supported by expansion of domestic gas production infrastructure on the east coast. Gas is a critical component of all viable future electricity grid options. There should be no equivocation, unless it is preferred to maintain coal generation indefinitely. Gas will be the bridge to and ongoing support to reliable nuclear generation.

If it is desired to maintain some level of wind & solar in the grid, the substantial gas generation in this Case provides plenty of scope for backing up wind & solar. However, this will lower the capacity factors of the gas plants thus increasing their unit costs and the wind & solar will incur additional capital costs and increased emissions from mining, processing and manufacture of wind & solar.

Again, a Trade-off Analysis is needed for this Case.

**A 58/31% Nuclear/Gas Grid Case**

This Case increases nuclear power generation while reducing gas and maintaining hydro outputs. The increased capital cost relative to the previous case of 40% nuclear needs to be traded off against the potential for emissions reductions.

| | |
|---|---|
| **From:** | [redacted] |
| **To:** | IPCN Enquiries Mailbox |
| **Cc:** | [redacted] |
| **Subject:** | Submission against the Wallaroo Solar Farm on behalf of Yass Landscape Guardians Inc. The AEMO 2024 ISP will not deliver Reliable Power-AEMO.s numbers do not add up. |
| **Date:** | Wednesday, 31 July 2024 8:54:36 PM |
| **Attachments:** | 240731 - The 2024 AEMO ISP will not deliver reliable power 31July2024.pdf |

Dear Independent Planning Commission

On behalf of the Yass Landscape Guardians Inc. I submit the attached report "**The AEMO 2024 ISP will not deliver Reliable Power-AEMO's numbers just do not add up"** as a submission against moving further forward with the Wallaroo Solar Farm SSD 9261283.

The Wallaroo Solar Farm proponent's representative at the IPC Meeting in Murrumbateman on the 18th July 2024 struggled to respond to many issues raised by members of the community that day?

Referencing Sunsave Energy solar panels may reach a maximum efficiency of 20% which reduces with the age of the panels. The Wallaroo Solar Farm rated at 100MW therefore on the best days will generate 20MW initially? A 100MW commercial installation thus appears to be financially unviable? Even if it ever reaches its maximum output of that 20%?

Best regards

John McGrath

SecretaryYass Landscape Guardians Inc

**From:** [redacted]
**To:** IPCN Enquiries Mailbox; [redacted]
**Cc:** [redacted]
**Subject:** Wallaroo Solar Farm Submission on behalf of the Yass Landscape Guardians Inc.-Missing Whole-of Systems Cost Model in the AEMO 2024ISP
**Date:** Wednesday, 31 July 2024 6:46:41 PM
**Attachments:** SCEPTICISM IS A CRUCIAL ELEMENT IN ENERGY MIX Chris Mitchell - Business Australian 29 July.pdf

---

Dear Independent Planning Commission
On behalf of the Yass Landscape Guardians Inc. I submit the attached report "**The Missing Whole-of-System Cost Model in the AEMO 2024 ISP The Real Cost of NEM Transition A report by Independent Engineers, Scientists and Professionals 31 July 2024** as a submission against moving further forward with the Wallaroo Solar Farm SSD 9261283.
The Wallaroo Solar Farm proponent's representative at the IPC Meeting in Murrumbateman on the 18th July 2024 struggled to respond to many issues raised by members of the community that day?
Referencing Sunsave Energy solar panels may reach a maximum efficiency of 20% which reduces with the age of the panels. The Wallaroo Solar Farm rated at 100MW therefore on the best days will generate 20MW initially? A 100MW commercial installation thus appears to be a financial failure if it ever reaches its maximum output of that 20%?
Best regards
John McGrath
SecretaryYass Landscape Guardians Inc

**Yass Landscape Guardians**

Yass Landscape Guardians Inc.
C/o John McGrath
1599 Black Range Road
Yass NSW 2582
Ph. [redacted]
[redacted]

31st July 2024

Independent Planning Commission
Suite15.02
135 King Street
Sydney NSW 2000
ipcn@ipcn.nsw.gov.au

Dear Independent Planning Commission
On behalf of the Yass Landscape Guardians Inc
We wish to oppose the Wallaroo Solar Farm SSD-9261283 for the following reason, the likely contamination of the environment whether the direct impact on the foot print of the development of the Wallaroo Solar Farm.
Heavy metals released for instance in the event of a heavy hail storm as happened through that area in on 20th January 2020.
The large hailstones smashed windows in homes, motor vehicles and damaged the same vehicles to the point of write-off? The same hail storm stripped tress and caused flooding?
Once the glass is smashed on the panels of a solar installation then heavy metals will not only contaminate the footprint of the solar farm but should this contamination reach the nearby streams, Ginninderra Creek for instance which feed into the Murrumbidgee than everyone's property downstream is at risk of being contaminated?
As you are aware My Sator and orange grower from Griffith in the NSW Riverina spoke passionately about the outcome for their irrigated crop should the Murrumbidgee River become contaminated from this solar farm.
Likewise, a local wind producer also delivered to the Wallaroo Solar Farm IPC on a very similar vane?
So, pollution/contamination from the Wallaroo Solar farm is a real possibility thus why should this project move forward?

Regards
John McGrath Secretary
Yass Landscape Guardians Inc.

"*From Conroy's Gap to Castlereagh there's none can ride like me*" A.B. Banjo Patterson

**Yass Landscape Guardians**

Yass Landscape Guardians Inc.
C/o John McGrath
1599 Black Range Road
Yass NSW 2582
Ph. [redacted]
[redacted]

31st July 2024

Independent Planning Commission
Suite15.02
135 King Street
Sydney NSW 2000
ipcn@ipcn.nsw.gov.au

Dear Independent Planning Commission

On behalf of the Yass Landscape Guardians Inc

We wish to oppose the Wallaroo Solar Farm SSD-9261283 for the following reason, allowing the Wallaroo Solar Farm to be constructed contravenes Australia's Signatory to the Paris Agreement 2015 Article 2, Section 1 (b) as it will cover once productive farming/grazing land? Viz

**THE PARIS AGREEMENT - 2015**

*The Parties to this Agreement*,

*Being* Parties to the United Nations Framework Convention on Climate Change, hereinafter referred to as "the Convention",

**Article 2**

1. This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

a. Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

b. **Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;**

This scenario will be the ultimate end should the Wallaroo Solkar Farm go ahead and decimate currently productive rural land?

Regards

John McGrath Secretary

Yass Landscape Guardians Inc.

*"From Conroy's Gap to Castlereagh there's none can ride like me"* A.B. Banjo Patterson

**Yass Landscape Guardians**

Yass Landscape Guardians Inc.
C/o John McGrath
1599 Black Range Road
Yass NSW 2582
Ph. [redacted]
[redacted]

31st July 2024

Independent Planning Commission
Suite15.02
135 King Street
Sydney NSW 2000
ipcn@ipcn.nsw.gov.au

Dear Independent Planning Commission
On behalf of the Yass Landscape Guardians Inc
We wish to oppose the Wallaroo Solar Farm SSD-9261283 for the following reason as these Solar Farm installations have self-ignited, example being the Beryl Solar farm fire near Gulgong a little over a year ago in April 2023.
What contingency plans are in place should the Wallaroo Solar farm given its proximity to and west of the Australian Capital Territory (ACT) ignite on a catastrophic Summer's Day?
This installation should it move forward and it does ignite as above the fire will quickly spread and be in and amongst the homes in 3 Canberra NSW suburbs of West MacGregor, Dunlop and Ginninderry and the Village of Hall. A major arterial road into the ACT the Barton Highway would be immediately impacted by smoke drift?
Who will ultimately take the blame for such an event? The owner of the Wallaroo Solar Farm, the host of the land that the Wallaroo Solar farm sits on or the public purse?
The toxic fumes from a fire in an installation such as the Wallaroo Solar Farm will cause major environmental and human impacts until the fire can be contained?
Something to consider is fire?

Regards
John McGrath Secretary
Yass Landscape Guardians Inc.

"*From Conroy's Gap to Castlereagh there's none can ride like me*" A.B. Banjo Patterson

**Yass Landscape Guardians**

Yass Landscape Guardians Inc.
C/o John McGrath
1599 Black Range Road
Yass NSW 2582
Ph. [redacted]
[redacted]

31st July 2024

Independent Planning Commission
Suite15.02
135 King Street
Sydney NSW 2000
ipcn@ipcn.nsw.gov.au

Dear Independent Planning Commission
On behalf of the Yass Landscape Guardians Inc
We wish to oppose the Wallaroo Solar Farm SSD-9261283 for the following reason, due to the ongoing farce where so-called renewable energy generation sources are continually approved whilst it is well known that in NSW there is currently **NO COMPULSORY DECOMMISSIONING LEGISLATION FOR RENEWABLE ENGERY GENERATORS?** Therefore, why are these projects continually approved when this lack of legislation ultimately means there is no certainty in the community that these projects will ever be decommissioned?

Regards
John McGrath Secretary
Yass Landscape Guardians Inc.

"*From Conroy's Gap to Castlereagh there's none can ride like me*" A.B. Banjo Patterson

**Yass Landscape Guardians**

Yass Landscape Guardians Inc.
C/o John McGrath
1599 Black Range Road
Yass NSW 2582
Ph. [redacted]

31st July 2024

Independent Planning Commission
Suite15.02
135 King Street
Sydney NSW 2000
ipcn@ipcn.nsw.gov.au

Dear Independent Planning Commission
On behalf of the Yass Landscape Guardians Inc
We wish to oppose the Wallaroo Solar Farm SSD-9261283 for the following reason, has the IPC made absolutely sure that the proponent developer for the Wallaroo Solar Farm has adequate indemnity insurance to cover any catastrophe that may be instigated within the footprint of the Wallaroo Solar Farm?
Likewise, will any subsequent owner of the Wallaroo Solar farm be adequately covered by insurance say should a fire ignite within the foot print of this installation and impact the nearby ACT/NSW suburbs of West MacGregor, Dunlop or Ginninderry?

Regards
John McGrath Secretary
Yass Landscape Guardians Inc.

"*From Conroy's Gap to Castlereagh there's none can ride like me*" A.B. Banjo Patterson

**Yass Landscape Guardians**

Yass Landscape Guardians Inc.
C/o John McGrath
1599 Black Range Road
Yass NSW 2582
Ph. [redacted]
[redacted]

31st July 2024

Independent Planning Commission
Suite15.02
135 King Street
Sydney NSW 2000
ipcn@ipcn.nsw.gov.au

Dear Independent Planning Commission
On behalf of the Yass Landscape Guardians Inc
We wish to oppose the Wallaroo Solar Farm SSD-9261283 for the following reason, in 2 instance renewable energy projects have been approved by their relevant IPC to connect to TransGrid transmission lines that never had the capacity to accept further generation?
Bango Wind Farm was originally approved by the appropriate IPC to connect to the 999 Yass Cowra 132KV transmission line. The 999 Yass Cowra 132KV lacked any capacity for further generation? Bango Wins Farm was originally constructed with the proponent and TransGrid fully aware of the lack of capacity for the 999 to accept further generation?
Somehow without explanation the Bango Wind Turbines were connected to the parallel transmission line the 973 Yass Cowra 132KV transmission line?
The Coppabella wind turbine project was approved by the 2018 Coppabella WF IPC to connect to the existing 132KV transmission line the 99M. The 99M as it stood had at best a capacity of 24MW on a cold winter's night, and no capacity to accept the alleged output of the 79 Coppabella wind turbines of approximately 280MW?
So, on behalf of Yass landscape Guardians Inc. I implore the Wallaroo Solar Farm IPC to investigate where the proponent for the Wallaroo Solar farm is intending connection to, hopefully a TransGrid transmission line that that said transmission line has the capacity to accept the alleged 100MW output of this solar panel installation? Then whether the substation busbar that that line delivers to has the required capacity?
Regards
John McGrath Secretary
Yass Landscape Guardians Inc.

*From Conroy’s Gap to Castlereagh there’s none can ride like me*” A.B. Banjo Patterson