

Contact Details

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Affected property:

Submission Details

I am: a representative of a company/other organisation affected by the proposal

I am - Other:

My position is: I oppose the development

Do you have concerns regarding the proposed development?: Yes. Riverland Solar & BESS is a Toxic Contaminating, Energy Poverty, Fake Green Grift & Ponzi Scheme/Scam that DEFIES all aspects of the NEL objective & all Principles of Ecologically Sustainable Development. As RenewaBulls DON'T WORK MOST OF THE TIME, ARE THE ASBESTOS OF THE FUTURE & A TROJAN HORSE FOR COMMUNISM - MASQUERADING AS ENVIRONMENTALISM - Toxic PFOS COATED, HEAVY METAL LEACHING Riverland Solar & increased capacity, INCAPABLE, FILTHY BESS is AGAINST OUR WILL & AGAINST THE BEST INTERESTS OF AUSTRALIA! It's TREACHEROUS to DELIBERATELY POISON THE PUBLIC, OUR LIFE SUSTAINING SOIL, VITAL WATER SOURCES & PRECIOUS BIODIVERSITY with TOXIC JUNK that's reliant on our most hostile enemy the CCP. ASBESTOS IS BANNED, PFOS IS BANNED yet there is NO DUE DILIGENCE & NO ESSENTIAL RISK RESEARCH done for UNclean, UNREGULATED RenewaBULL. This ENERGY DEPRIVING JUNK that's UNETHICALLY PRODUCED using BLOOD COBALT is enabling the CCP to unconscionably control the Grid!

What could be done to address your concerns?: SACK THE GOVERNMENT FOR FAILING THEIR DUTY TO PROTECT ITS CITIZENS. BAN ALL CHINA's RenewaBULL JUNK! BUILD NEW, RELIABLE, AFFORDABLE, SECURE, SAFE, PLENTIFUL, 24/7, AUSTRALIAN, BASE LOAD HELE COAL & NUCLEAR POWER STATIONS for FAR, FAR SUPERIOR POWER THAT WORKS ON DEMAND & protects Energy Security, Food Security, Economic Prosperity, Productivity, Precious Biodiversity & National Security.

Other general comments: South Australia's ElectraNet is 45.89% owned/controlled by the STATE GRID CORPORATION OF CHINA WHO HAVE NO

ALLEGIANCE TO AUSTRALIA!! NSW HATES SABOTAGING PROJECT ENERGY CONNECT!! No way does SW NSW, the RIVERINA & FARRER want this insidious nightmare that's nothing but a RenewaBULL Freeway to the Chinese Yuan & the CCP's ASEAN POWER GRID AGENDA!

PresentInPerson: I wish to be heard in support of my representation

NominatedSpeaker: Cathryn Nitschke

Supporting Documents

FilesUp: Photo-38.pdf, type application/pdf, 2.3 MB

FilesUp: Photo-39.pdf, type application/pdf, 1.8 MB


FilesUp: Kennedy-Dinawan-Mar-4-2026_Redacted2.pdf, type application/pdf, 653.2 KB

FilesUp: TOXIC-CONTAMINATING-SOLAR,-WIND-TURBINES-and-BESS2.pdf, type application/pdf, 138.7 KB

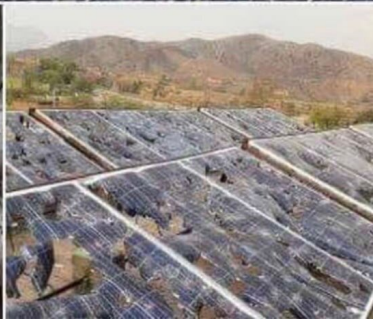
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**TOXIC
HAZARD**



TOXIC
RenewaBULLs
ARE THE ASBESTOS
OF THE FUTURE
BAN PFOS SOLAR



Toxic smoke warning for community

Chris McLennan

CFA crews have brought a fire at a Raywood solar farm under control.

Ten Country Fire Authority units responded to a fire at the solar farm about 28km north of Bendigo at 5.50pm on Thursday.

The solar farm was located in McQuarters Road, Raywood.

While near Cohuna, one of Victoria's biggest solar farms has been out of action for almost a year. Built at a cost of around \$67 million in 2019, the Cohuna solar farm is still undergoing a refit after a fire in late 2023.

Meanwhile on Thursday, 10 CFA units from Bridgewater, Campbells Forest, Eaglehawk, Golden Square, Raywood and Woodvale attended the Raywood solar farm fire.

Police and Powercor were

also on the scene. A transformer caught fire on the "moderately sized commercial solar farm" and crews used foam to extinguish it, the CFA said in a statement.

A warning was issued to the Raywood community because of the black toxic smoke drifting over the township.

"Access was difficult for crews because of the density of the smoke," the CFA said.

The scene was under control about 8.30pm.

Energy Safe Victoria is investigating the cause of the fire.

There was a small fire at a solar farm at Walla Walla, just north of Albury, back in early January as well.

Local farmers blamed the owner of the solar farm for failing to adequately maintain the grass around the farm.

8 Tooborac fire - page 10



A transformer at a central Victorian solar farm caught fire late on Thursday. Picture CFA.























 **PFAS**

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AUSTRALIAN
AGRICULTURE
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PFAS 

Foreword

“

Communities are clear in their expectations: genuine early engagement, transparent communication, opportunities for local employment and procurement, and visible long-term legacies.

Australia's clean energy transformation is not just an infrastructure challenge – it is a nation-building project that reaches deep into our regions, our industries and our communities. The success of this transformation depends not only on how much renewable capacity we build, but on how well we build it: in partnership with Traditional Owners, with respect for Country and with a clear commitment to leaving lasting value for the communities who host these projects.

The Clean Energy Council's Best Practice Charter exists to guide us in that task. Each of the signatories that have reported against the charter this year, have shown that good practice is more than compliance – it is about trust, collaboration and accountability. Whether it's co-designing benefit-sharing funds with local councils, supporting First Nations equity partnerships, integrating agriculture and solar, or ensuring worker accommodation doesn't strain local housing, the message is the same: when we get it right, everyone benefits.

As someone who has spent much of my career working to strengthen communities and economies, I know that transitions of this scale only succeed when people feel included, respected and heard. This snapshot, taken from more than 400 examples, demonstrates that developers are listening – and importantly, learning – from the lived experience of regional Australians.

Of course, there is more to do. Communities are clear in their expectations: genuine early engagement, transparent communication, opportunities for local employment and procurement and visible long-term legacies. Getting this right is not a 'nice to have'; it is central to project delivery, investor confidence and public trust in the clean energy transition.

This year's reporting against the charter provides not only evidence of progress but also a blueprint for what's possible when industry lifts the bar together. It shows a sector that is maturing – one that is embedding social performance as deeply as engineering or finance. That is the pathway to a transition that is not only fast, but fair; not only ambitious, but enduring.

I am proud to lead the Clean Energy Council at this pivotal moment. Together, with governments, industry and communities, we will deliver a transition that creates opportunity, strengthens resilience and leaves a legacy, of which Australians can be proud.



Jackie Trad
Chief Executive Officer
Clean Energy Council

Best Practice Charter commitments

- 1 We will engage respectfully with the local community, including Traditional Owners of the land, to seek their views and input before submitting a development application and finalising the design of the project.
- 2 We will provide timely information and be accessible and responsive in addressing the local community's feedback and concerns throughout the life of the project.
- 3 We will be sensitive to areas of high biodiversity, cultural and landscape value in the design and operation of project.
- 4 We will minimise the impacts on highly productive agricultural land and explore opportunities to integrate agricultural production.
- 5 We will consult the community on the potential visual, noise, traffic and other impacts of the project, and on the mitigation options.
- 6 We will support the local economy by providing local employment and procurement opportunities.
- 7 We will offer communities the opportunity to share in the benefits of the project, and consult them on the options available, including the relevant governance arrangements.
- 8 We commit to using the project to support educational and tourism opportunities where appropriate.
- 9 We will demonstrate responsible land stewardship over the life of the project and welcome opportunities to enhance the ecological, cultural and/or agricultural value of the land.
- 10 During the life of the project, we will recycle waste materials where feasible and commit to responsible decommissioning or refurbishment/repowering of the site at the end of the project's life.

Best Practice Charter signatories



The Four Principles of Ecologically Sustainable Development (ESD) are:

- **The Precautionary Principle:**

When there is a threat of serious environmental damage, action should be taken to prevent it, even if there is not full scientific certainty.

- **Intergenerational Equity:** The current generation should take care of the environment so that future generations can benefit from it.

- **Conservation of Biological Diversity:** The diversity of plants and animals should be preserved.

- **Improved Valuation, Pricing, and Incentive Mechanisms:** The costs of pollution and waste should be paid by those who cause them.



LPA Accreditation

Food safety on your property

Question: 2.8

Do livestock have access to leaking electrical transformers, capacitors, hydraulic equipment, solar panels, wind turbines, coal seam gas structures or coal mine wastes?

- Yes
- No
- I am now aware and making plans to restrict access.

[← Back](#)

[Save and continue](#)

Select your answer and then click 'Save and continue' to continue



Advisory Note AN-004

Extinguishment of Li-Ion Battery Fires

This advisory note provides important information regarding the evaluation and verification of evidence of conformity for the extinguishment of Li-Ion batteries under the CSIRO Verification Services' ActivFire® Scheme.

With increasing usage of Li-Ion batteries in our daily lives, there has been an increase in documented fires, both in Australia and globally, caused by failure of Li-Ion batteries. Some of these fires have caused serious damage to properties in Australia, while fatalities have occurred overseas, throwing a spotlight onto the safety of Li-Ion batteries.

While a number of Li-Ion battery fire extinguishment solutions have been proposed globally, no Australian Standard has been published to provide performance requirements for the extinguishment of fires related to Li-Ion batteries.

In Australia, the Australia Competition and Consumer Commission (ACCC) sets out a list of mandatory standards to make particular safety or information features on products compulsory for legal supply of the product into the Australian market. This includes portable aerosol fire extinguishers and portable non-aerosol fire extinguishers. More information can be found here: <https://www.productsafety.gov.au/product-safety-laws/safety-standards-bans/mandatory-standards>.

Accordingly, CSIRO Verification Services' ActivFire® Scheme advises its stakeholders that it *has not and will not* certify, and thus provide a Certificate of Conformity, that any fire extinguisher can effectively extinguish a Li-Ion battery fire.

CSIRO Verification Services' ActivFire® Scheme supports the development of an Australian Standard and/or acceptance of an internationally recognised Standard that includes performance requirements for the extinguishments of Li-Ion battery fires and will continue to work with key stakeholders in the development of such a Standard.

Please contact your local fire brigade in the case of a Li-Ion battery fire.

Issuing Authorities

Kai Loh, Executive Office, ActivFire scheme – CSIRO Verification Services

Tracey Gramlick, Deputy Director – Growth and Strategy, Infrastructure Technologies

Issue date

30-Nov-2023

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****NHMRC Updated Australian Drinking Water Guidelines - 25th June 2025**

- revised chemical fact sheets on **per- and polyfluoroalkyl substances (PFAS), selenium, lead and manganese**
- an information sheet on **metals and metalloids** leaching from plumbing products
- a new chemical fact sheet on **bismuth**
- a new combined chemical fact sheet on **silicon and silica**

Reduce health risks from PFAS chemical exposure in Australian Drinking Water:

***PFOA** (perfluorooctanoic acid): 200 ng/L

***PFOS** (perfluorooctane sulfonic acid):
8 ng/L

***PFHxS** (perfluorohexane sulfonic acid):
30 ng/L

***PFBS** (perfluorobutane sulfonic acid):
1000 ng/L

***GenX chemicals** (hexafluoropropylene oxide dimer acid and its ammonium salt)

COMMONWEALTH PFAS BAN

Wind Turbine Blades & Lithium-ion Batteries are Toxic PFAS Contaminants

Solar Panels + the Electrical Wiring sourced from China are both coated in PFOS (Perfluorooctane Sulfonate or Perfluorooctane Sulfonic Acid) listed as a Toxic Contaminant in the updated Australian Drinking Water Guidelines.

Due to these 'Forever Chemicals' being linked to cancer, birth defects, liver disease, thyroid disease, plummeting sperm counts and a range of other serious health problems the

Commonwealth Government has banned the import, use and manufacture of some of the more prominent types of PFAS (PFOS, PFOA and PFHxS) from 1st July 2025 - (21 Feb 2024)



W7000



HAVE YOUR
POWER BILLS
GONE DOWN
NO
WEAK
LEADER
= WEAK
COUNTRY





IPCN Presentation on Dinawan Solar Energy Hub + BESS – Spark Renewables Development of a 800 MW Solar Hub SSD-50725959. 1.2 GW of Wind Power and 300 MW BESS Included in the Total Hub

Complete Lack of Diligent Field & Environmental Risk Research Prior to This Development

An Expert Opinion Submitted by Professor Emeritus Ivan Kennedy to Independent Planning Commission NSW on Mar 4, 2026

Focussing on Solar Power, Attention is Drawn to Several Issues Lacking Diligent Prior Research for Environmental Risk and Its Mitigation.

- I. The Environmental Toxicity of the Solar Panels Employed to Soil and Livestock Subject to Slow Leaching or Its Acceleration by Hail Storm Damage; Recycling at End of Life Cycle is No Solution.**
- II. Possible Interaction Between Grazing Ruminants and rate of Degradation of Solar Panels; New Information Needing Research**
- III. Several Specific Questions Require Answers as Responses to These Issues**

Due diligence should be exercised in assessing risks to farmlands and environment when introducing renewable Solar or Wind Energy. The Independent Panel should justify its independence by ruling whether the gaps in diligence to be revealed here are valid, defining who is responsible. In my professional opinion based on years developing expertise in risk analysis, if the IPCN was truly diligent it could settle concerns I raise in my submission by requesting quality-controlled analyses of soil and ground water under existing solar facilities subject to more than 10 years of slow corrosion, as well as at sites where serious storm damage has occurred as I will foreshadow. However, no such analyses have been commissioned anywhere by Authorities, I assume for fear scientific results from these could halt development of solar power.

Negligent or legally culpable failure by authorities, proposers or planners to conduct risk research under Australian environmental conditions for solar farms can justify a class action for damages for loss of productivity in farmlands and the environment. While climate change is characterised by uncertainty in causes and remedies, lacking necessary prior research, this risk must loom larger. Unintended consequences become more likely.

From professional expertise developed in research on environmental and climate science at the University of Sydney, managing risks to agricultural productivity and toxicity for farmers,

my research group opposes this development. It is likely to damage productive farmland irreversibly and fails to diminish climate risks. For a previous submission on heavy metal toxicity from solar panels see Kennedy (2025, Submission 240002 Muswellbrook Solar Farm).

I: The Inherent Environmental Toxicity of the 800 MW of Solar Panels Employed

About 30 tonnes of metallic silver is embedded in the monocrystalline silicon solar panels at Dinawan (Balji et al. 2024), just under 0.1% of the weight of the installation. Crystalline silicon photovoltaic modules contain approximately 75% of the total weight from the surface of the module (glass), 10% polymer (polyvinylidene difluoride (organofluorine PVDF) & ethylene vinyl acetate (EVA)), 8% aluminum as framing, 5% silicon (solar cell), 1% copper (interconnectors) and 0.1% silver contact lines, with other metals like tin and lead. The cells are electrically interconnected by copper, creating a string of cells in series.

New solar panels have no immediate toxic effect, with heavy metals contained in glass, unless cells are broken. However, if only 1% of this chemical silver becomes leachate in the Dinawan solar panel lifetime of 20 years, because of extreme environmental conditions in temperature, ultraviolet radiation or impulsive pressures in meteorological hailstorms, then prime land needed for agriculture could be lost forever. Remediation of the top layer of soil from bound silver or other heavy metals will be economically impossible. Faulty solar panels are usually prohibited by government from disposal in landfill because of their heavy metal content, although the risk of contamination of groundwater is real, particularly if soil texture is low in organic-clay content with poor metal binding capacity. Silver is well known to be highly toxic to microorganisms (Levard et al., 2013).

II: Possible Harmful Interaction Between Grazing Ruminants and Degradation of the Solar Panels

Although grazing sheep under solar panels is even recommended, combining such a practice in close proximity to solar panels is probably incompatible. Hydrogen sulfide (H₂S) may be produced in anaerobic conditions deeper in soil, increased by deposition of manure and flooding by rainfall. Furthermore, sheep may exhale H₂S produced in the rumen and another sulphur-containing compound, dimethyl sulphide (DMS), is also exhaled by ruminants near ppm in eructed breath. DMS from breath of ruminants has been identified as contributing 10% of sulphur to the global atmosphere which was estimated to be between 2.1 and 5.5 Tg S yr⁻¹ (Hobbs et al., 2001) There has been no recognition of beneficial contributions from livestock to DMS that regulates global climate by inducing cloud formation. Both of these gaseous sulfur compounds readily form sulfides with silver, particularly with a high surface area to weight ratio as in solar panels. The effect of these reactions on corrosion of silver in solar panels is unknown. Although Ag₂S is insoluble, the effect of flowing electricity in silver wires, daily variations in temperature near 100 °C and even mild acidity in rainfall has not been examined experimentally. Even low rates of corrosion over many years may have

a cumulative effect of leaching rates, potentially contaminating wool or meat of livestock and rendering them unsaleable. The risk of such accelerated corrosion and soil contamination cannot be ignored.

III. Specific questions addressed to Spark Renewables the IPCN

Q.1: What monitoring of leachate from solar panels will be conducted? Livestock such as sheep may be impacted by such leachate and quality regulations may prohibit marketing of such livestock as is normal for toxic constituents. This is explained in more detail below.

Q2: In case of major damage to solar panels, such as severe hail storms, hail damage shattering panels or bushfire possibly making silver and other metals volatile, what measures will be taken to mitigate accelerated release of toxic metals or PFAS or other constituents released to air from the panels?

Q.3: How will such responses and reports investigating such issues be regulated? Who will be responsible?

I. Monitoring risks of soil and groundwater contamination from toxic heavy metals

For crystalline photovoltaic cells, silver paste is applied to silicon solar cells of panels to speed up electron transport from sunlight in a voltage gradient, for better electrical output efficiency. Silver can be reactive, particularly with hydrogen sulphide (Mukherjee et al., 2025) formed by plant metabolism from photosynthesis and slowly in soils under anaerobic conditions of respiration. The ubiquitous blackening of silver-plated vessels is evidence of this process, allowing surface leaching as ionic silver sulphide. Thin-film panels containing cadmium telluride rather than silver contain about 7 tonnes of heavy metal per 100 MW of power (Zapf-Gottwick, 2021). Field research by Yousuf et al. (2024) showed rice field solar panels experienced an increase in Cd levels from 0.47 mg/kg in 2022 to 1.55 mg/kg in 2023, although other metal concentrations decreased, probably a result of field surface variations and sampling challenges. In obtaining field data under solar panels, questions arise as to soil type and depth of infiltration of leachate from panels and the age of solar installations affecting the extent of corrosion.

Each solar panel rated for 400 W could contain about 10-20 g of dispersed silver wire (Ag) (Rout et al., 2025), as well as copper and other minor metals. A 500 MW facility could contain up to 20-30 tonnes of silver, dispersed in the glass panels, to improve flow of electricity. Even a small lifetime leaching rate of less than 1-5% could lead to serious 'forever' contamination of soil, preventing plant growth.

The specific heavy metal composition of the bifacial solar panel modules used at the Dinawan Solar Farm is not publicly detailed, so these literature values are assumed as approximate. The International Energy Agency Report for the Technology Collaboration Programme gives Figure 4 as one example of bifacial PERT solar cell scheme invented at UNSW, showing front and rear metal grid material of aluminium and silver (Ag). See <https://iea-pvps.org/wp->

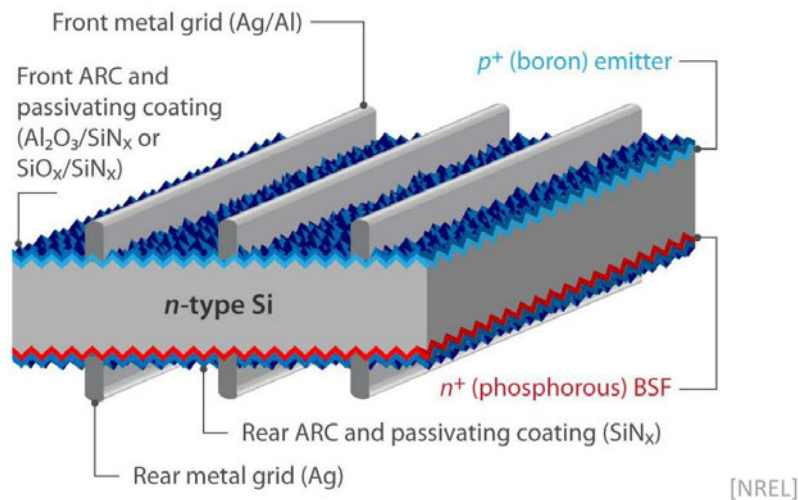


Figure 4: Typical bifacial n-PERT cell scheme.

More recently, shown as Figure 5 in the above reference, more efficient hetero-junction solar cells (HJT) that specify silver (Ag) only for front and rear metal grids have been developed and may be employed in the Dinawan depending on cost.

- i) **Recommendation for immediate soil testing and future monitoring of current solar farms and urban panels sites.** Have risks of toxic contamination of soil been scientifically assessed by accurate monitoring under Australian conditions? Such a programme would require prolonged collection of runoff from panels and precision analysis after concentration of liquid samples. Short-term laboratory testing overseas has confirmed leaching of broken cells (Nover et al. 2021), but not for testing in solar panels after environmental stressing for years. In Australia, no peer-reviewed long-term statistically valid quality-controlled analyses of soil under solar panels have been conducted after 20 years maturing, despite some current retirement of solar farm sites, possibly for fear of positive results and lack of funding.
- ii) **Likelihood of thunderstorms panel-shattering hail greater than 25 mm.** Misadventure such as thunderstorms with large hail destroyed much of a functioning Houston solar farm in Texas, USA, in March, 2024, just two years after its commission. This is not an isolated incident. Raupach et al. (2023) reviewed evidence for hailstorm damage in Australia. This July, Raupach and Aldridge (2025) published their modelled prediction that risk from hailstorms is increasing with warming, expected to increase hail size in the 21st century, potentially exceeding 100 mm in diameter. For example, Kalgoorlie showed increases in both giant hail (from ~12% to ~21%) and 100 mm hail (from ~1% to ~2%). Even more common 25 mm hail stones can shatter glass-enclosed solar cells. Fragments from shattered panels will certainly be leachable to soil, with mildly acid rain. At least one such major hailstorm event is probable during the operation cycle of each solar farms of 20-30 years, a period claimed by manufacturers for operation retaining at

least 80% efficiency. Slightly thinner glass used in bifacial panels as proposed for Dinawan solar farm are reported to fragment more easily into smaller sizes (Solar Choice data) than monofacial cells. Once shattered on soil corrosion would be rapid by oxidation, leaching into runoff water as an ionic form (Ag^+), binding firmly with organic matter complexes with clays in soil. Silver ions are at the highest scale of heavy metal toxicity just below mercury (Tsepina et al. 2022); they bind in ionic form to essential components of living systems like enzymes and rank next after chromium on the list of mutagenic substances, potential carcinogens.

- iii) **Estimating toxic concentrations in soil underneath panels.** According to available information, a concentration of silver in soil considered toxic generally falls within the range of 1-10 mg/kg (1-10 ppm by weight) depending on the soil type and the form of silver present in soil (Tsipina et al., 2024); however, even concentrations as low as 0.1 mg/kg may show detrimental effects on soil microbial communities in certain situations. Such a low concentration might be reached with as little as 0.1% lifetime leaching of silver from panels to soil. Sterilisation of drinking water at risk from *Legionella* is achieved by electrolytic formation of silver ions (Ag^+). For soil density of 1.3 or around 1,300 kg per cubic metre, and for a mid-range toxicity 5 mg/kg (5 ppm by weight), then a total release of only 1.3% or 650 mg of silver per metre square out of 50 g silver would contaminate 130 kg of soil to a depth of 10 cm, enough to prevent all surface plant life. Alternatively, considering there is 50 g of heavy metal toxin in every kW of solar panels, 0.5 g or 1% would contaminate 130 kg of soil to 10 cm depth to 3.8 ppm by weight of soil. Once released as leachate from panels, heavy metal ions may bind firmly to surface soil and the contaminated area lost to agriculture as a hazardous site, possibly forever.
- iv) **Need for risk research for the probability of toxic impacts.** A legitimate question regards chaotic meteorology (Raupach and Aldridge, 2025) that may be further induced over solar farms with low albedo. A warmer surface on solar farms will cause more evaporation, providing the huge latent heat energy of water vapour that at 5% of air powers major storms. What is the likelihood of major hailstorms in the 20-30 year life cycle of solar panels? The 350 MW “Fighting Jays” solar farm’s lifetime for many of the panels was reduced to zero less than 2 years from July 2022. Research is needed to determine the risk of leaching under such circumstances, as conducted by Sharma et al. (2021) for solar panel waste, indicating USEPA toxicity characteristic leaching procedure (TCLP) leachate levels in ppm in water. This research study indicates that solar panels should not be disposed of at end-of-life in land fill, because of toxicity in ground water, particularly if at acidic pH values.
- v) **Benefits of risk research and management of solar panels.** There may be ways of reducing damage, such as protection from storm or hail damage, such as orientation of panels, use of monofacial panels or avoidance of leachable sandy soils. Professor Penelope Crossley of the University of Sydney advised NSW Parliament on this matter of inadequate faulty or end-of-life solar panel disposal, provided as expert legal opinion; she stated that no legal methods of disposal for

used solar panels are currently available in Australia. This practice confirms their hazardous toxic nature, at variance with the Safe Energy Council. Dismantling and transport costs for the major components would be uneconomic and the quantities of silver involved from 30 million tonnes of super structure such as aluminium at Dinawan make recycling practically impossible.

This analysis makes the following recommendations:

- (i) A life cycle risk analysis for the Dinawan site should first be performed, including clear responsibility for funding safe methods of panel disposal, given chemical recycling in Australia is not economic nor likely to be. We cannot accept a high probability of losing such an area of our productive soils, either from future agriculture or the natural environment.
- (ii) Nover et al. (2021) have confirmed ease of leaching from photovoltaic modules focussing on cadmium for 1.5 year leaching experiments, less than one-twentieth the expected module lifetime. Short- term experiments with crushed PV modules are irrelevant, given the naturally more disruptive environmental variables of oscillating temperature, leaching by acid rainwater with pH value less than 7 and significant ultraviolet radiation, stressing the glass modules, causing their structural deterioration by separating their layers and increasingly exposing metals to leaching. Poddar et al. (2024) point to the greater rate of solar panel deterioration with warming. Meteorologists have even proposed recently that very large, blackened panels could be used to increase precipitation from convective rainfall (Branch et al. 2024); this could apply to a 15,000-ha low albedo site. Hail damage might be minimised by orientation of panels, and protective shielding in storm prone areas of higher humidity. Such measures should be investigated as risk mitigation by proprietors for insurance, as recommended by Raupach and Aldridge (2025).
- (iii) Who is responsible for monitoring? Properly conducted periodic analyses of runoff and soil under solar installations should be performed at least annually to help ensure environmental safety is guaranteed. No long-term leaching experiments have been performed, suggesting too much confidence by the SEC and IPCN regarding safety because of the noble purpose of combating climate change. By contrast, trials including simulated hail damaged panels are needed. Such soil and water analysis is readily available commercially, or in government departments. If serious leaching is detected, who will enforce the process of replacement with non-leaching panels?

In the Muswellbrook Solar SSD 46543209 (27th May 2025), risks from solar panels (Kennedy, Submission 240002) were disregarded casually without counter evidence in the following statement:

The Large-scale Solar Energy Guidelines, Frequently Asked Questions (Guideline FAQ) states the following in relation to the potential for solar panels to cause contamination (pages 4-5): “The metals in solar panels (including lead, cadmium, copper, indium, gallium and nickel)

cannot be easily released into the environment. This is because metals such as cadmium telluride or cadmium sulfide are enclosed in thin layers between sheets of glass or plastic within the solar panel. Because of this, the use of metals in solar panels has not been found to pose a risk to the environment. To readily release contaminants into the environment, solar panels would need to be ground to a fine dust." The Commission acknowledges the community's concerns on contamination, however, accepts the advice of the Department as outlined in the Guidelines FAQ.

On the contrary, the potential for longer term toxic effects in soil is easily established by previous research elsewhere for the solar farm's anticipated 30-year term, including risks from storms. From other research this is beyond dispute. Nor has any diligent research on these risks been performed for the locality of Dinawan by IPCN. A moratorium on installation could be regarded as legally warranted, implying defence for operators of Dinawan Solar Farm, and the IPCN, in case of future class actions lack of diligence and losses of land productivity. Evidence that this detriment has occurred will be easily obtained, simply by comparisons with well separated control soils nearby not exposed to solar panels.

Our review shows that there are serious unanswered question regarding solar panel toxicity that could in future amount to local catastrophic consequences. No definitive research has been conducted globally. It also seems that silver is assumed as benign and often not even mentioned, So studies on its environmental toxicity have been almost completely neglected.

Clean Energy Council Has No Evidence and Recycling can Only be Post-Solar

A pamphlet (August, 2025) from the Clean Energy Council entitled *Debunking Myths about Solar Panel Toxicity* unwisely discounts longer term toxic risks from panels, claiming all metal contents can be successfully recycled, ignores the previous toxic life cycle. The Clean Energy Council has no evidence to guarantee such a costly requirement, given accountability is not clearly allocated. Reliable evidence to the contrary is presented below of recycling's ineffectiveness, because it assumes all panels will survive for processing. The CEC has ignored the fact that only traces of heavy metal content, such as silver, cadmium, selenium, lithium, copper and even silica itself are needed to express lethal toxicity to living organisms. Silver ions are the second most toxic after mercury. The long life cycle of solar farms up to 30 years invalidates short term leaching tests on panels, unstressed by physical and chemical corrosion, including in turbulent storms, hailstorms and temperature extremes. The recycling concerns have very recently been taken up by researchers at Macquarie University in a patented Jet Electrochemical Silver Extraction (JESE) process, a "pressure washer" method using strong nitric acid to selectively dissolve and extract silver from discarded solar panels while leaving other components intact, including silicon wafers and glass. Their publicity confirms that standard solar panels contain 20 g of silver making the process possibly worthwhile since 630 g per tonne of solar panels, this is similar in content to average silver ores (Balaji et al. 2024). However, such recycling is only possible "after the event" with respect to possible soil and groundwater contamination.

Concern Regarding 1.2 GW of Wind Turbine Wakes at Dinawan

There is also legally culpable neglect of environmental risk research on introducing renewable wind energy. Does this lack of due diligence ignore potential loss of agricultural productivity and increased bushfire risk?

Key points regarding wind facilities:

- Complete lack of diligent research on potential landscape drying effect of wind turbine wake turbulence. None has been commissioned nor funded by government regulators.
- This lack of environmental research is negligent because of the scale of government plans to introduce some 7000 turbines by 2050, each similar in height to the Eiffel Tower or Crown Casino Barangaroo, like building 70 new skyscraper cities. This must change local weather.
- Our published research below [7](<https://doi.org/10.47852/bonviewAAES32021330>) predicts turbulent heating of wake air, increasing evaporation by disturbing the boundary layer.
- Case studies concerning necessary expansion of (i) Gingin Fire & Rescue, north of Perth after wind turbines were installed in 2019 (ii) the Lahaina Maui fire of August 2023 when 102 people died in the wake of Maui's largest windfarm (iii) many other wildfires in areas with wind turbines probably made more intense by magnified ignition and heat release from extra drying of combustible litter. Climate change has been blamed, without evidence.

For detailed reviews of these cases see:

- (i) Senate Committee of Inquiry on Energy Planning and Regulation, Submission 55 Kennedy 2024; see also 55.1 recommending 9 million ha Casuarinas as wood to replace coal.
https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Energy_Planning_and_Regulation_in_Australia/EnergyPlanning
- (ii) Select Committee on Information Integrity on Climate Change and Energy Submission 223 Kennedy 2025


Concluding With A Strong Recommendation to Pause Renewable Energy Introduction

Given uncertainty in causes of climate change and the probable futility of reaching zero carbon because of falling surface seawater pH values with warming calcification, emissions of CO₂ will continue (Kennedy et al., 2022; Kennedy et al., 2025a, 2025b). It is for this reason I object to these unnecessary developments that are scientifically futile. I predict that IPCN members will know that truth in the not too distant future. There is no urgency as Australia's renewables will only have a minor effect, if any, well after 2050.

We therefore recommend a pause for several years halt in renewable energy developments until benefits for managing climate change are proven. Risk management and quality controlled research should be employed to give clear scientific guidance for responsible

action. This will minimise the likelihood of the serious unintended consequences that we predict.

Yours sincerely,


Ivan R. Kennedy AM FRACI (tel. 0413071796,C81.745)
Professor Emeritus in Agricultural & Environmental Chemistry,
School of Life and Environmental Sciences, Councillor USAP,
Institute of Agriculture, University of Sydney NSW 2006

Mar 4, 2026

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Recycling of silver from photovoltaic modules supporting 30 kg content.

Branch, O., Jach, L., Schwitalla, T., Warrach-Sagi, K., Wulfmeyer, V. (2024) Scaling artificial heat islands too enhance precipitation in the United Arab Emirates. *Earth Syst. Dynam.* 15, 109-129. <https://doi.org/10.5194/esd-15-109-2024>.

Meteorological effects of solar panel absorptions.

Hobbs, P., Misselbrook, T., Cumby, T. and Mottram, T. (2001) The scope and contribution of volatile organic compounds to pollution from livestock. American Society of Agricultural and Biological Engineers (ASABE) (2026) 2950 Niles Road, St. Joseph, MI 49085 Phone: +12694290300 Fax: +12694293852

Kennedy, Ivan R., Runcie, John, Crossan, Angus N., Ritchie, Raymond J. & Marohasy, Jennifer (2025a) A Thermal Acid Calcification Cause for Seasonal Oscillations in the Increasing Keeling Curve. Cornell arXiv preprint <https://doi.org/10.48550/arXiv.2505.06253>

Outlines the TAC hypothesis for seasonal oscillations in the Keeling Curve promoted by warming.

Kennedy, Ivan R., Runcie, John W., Crossan, Angus N. & Ritchie, Raymond. N. (2025b) Has Seasonal Ocean Calcification Been Overlooked as a Cause of the Increasing Keeling Curve? A Thermal Acidifying Calcification Hypothesis. *Advances in Oceanography & Marine Biology* 4(3). DOI:10.33552/AOMB.2025.04.000590

Promotes global warming as a cause of emissions from surface seawater

Kennedy, Ivan R., Runcie, John W., Zhang, S., & Ritchie, Raymond J. (2022) A New Look at Physico-chemical Causes of Changing Climate: Is the Seasonal Variation in Seawater Temperature a Significant Factor in Establishing the Partial Pressure of Carbon Dioxide in the Earth's Atmosphere. *Thermo* 2022, 2(4), 401-434, <https://doi.org/10.3390/thermo2040028>
Establishes seasonal warming as the basis of oscillations in pCO₂

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Indicates rates of hydrogen sulphide formation from plants and soil, slow but surely and irreversibly binding to silver.

Nain, Preeti & Kumar, Arun (2020) Initial metal contents and leaching rate constants of metals leached from end-of-life solar photovoltaic waste; An integrative literature review and analysis. *Renewable and Sustainable Energy Reviews* 119, 109592. <https://doi.org/10.1016/j.rser.2019.109952>.
Classifies carcinogenic and non-carcinogenic heavy metals in photovoltaic cells and leaching rate constants indicating, with silver undecided re carcinogenicity.

Nover, J., Zapf-Gottwick, Feifel, C., Koch, M., Werner, J.H. (2021) Leaching via weak spots in photovoltaic modules. *Energies*, 14, 692 <https://doi.org/10.3390/en14030692>.
Longer term experiments show "it is possible to leach out all ... of the toxic elements from the photovoltaic modules".

Poddar, Shukla, Rougieux, Fiacre, Evans Jason P., Kay, Merlinde, Prasad, Abhnil A., Bremner, Stephen P. (2024) Accelerated degradation of photovoltaic modules under a future warmer climate. *Progress Photovoltaic Research Applications*, 32, 456-467. *Anticipating faster rates of degradation and performance with climate change.*

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Raupach, T. H., & Aldridge, J. (2025). Changes in hail damage potential in major Australian cities with global warming. *Geophysical Research Letters*, 52, e2025GL117676. First published: 28 July 2025
<https://doi.org/10.1029/2025GL117676>
Expected increased size of hail stones with climate change in the 21st century.

Rout, S., Jana, P., Borra, C.R., Önola, M.A.R. (2025) Unlocking silver from end-of-life photovoltaic panels: A concise review. *Ren. Sustain. Ener. Rev.* 210, 115205. <https://doi.org/10.1016/j.rser.2024.115205>.
This article reviews existing recycling technologies, with acidic solutions among the most popular for extracting silver from solar panels, indicating silver content.

Sharma, Hari Bhakta, Vanapalli, Kumar Raja Barnwal, Vikram Kumar Dubey, Brajesh, Bhattacharya, Jayanta (2021) Evaluation of heavy metal leaching under simulated disposal conditions and formulation of strategies for handling solar panel waste. *Science of Total Environment* 780, 146645.
Evaluates the leaching potential of the polycrystalline solar panel waste under different simulated disposal conditions

Tsepina, N., Kolesnikov, S., Minnikova, T., Timoshenko, A., Kazeev, K. (2022) Soil contamination by silver and assessment of its ecotoxicity. *Rev. Agric. Sci.* 10, 186-205. https://doi.org/10.7831/ras.10.0_186. *Negative effects of silver greater than 0.5 ppm decrease plant growth, suppress growth of earthworms, decrease soil bacteria and inhibit soil enzymes Silver is the second most toxic substance after mercury. As for mutagenic properties, this reactivity series is somewhat different from the toxicity series Cr6+ >> Ag > Hg > Cd, > Mo6+, Pb > W6+ > Cu.*

Yousuf, Hasnain, Zahid, Muhammad Aleem, Jony, Jaljalalul Abedin, Park, Sangheon, Madara, Polgampola Chamani, Song, Jae Chun & Yi, Junsin (2024) Assessing soil pollution concerns in proximity to Fence-type solar photovoltaic system installations. *Heliyon* 10 (2024) e32156. *The findings underscore the dynamic nature of heavy metal concentrations, emphasizing the importance of continuous soil quality monitoring to prevent contamination.*

Zapf-Gottwick, R.; Zorn, M.; Nover, J.; Koch, M.; Feifel, C.; Werner, J.H. (2021) Size- and Surface-Dependent Solubility of CadmiumTelluride in Aqueous Solutions. *Energies* 14, 398. <https://doi.org/10.3390/en14020398> *Recent thin-film solar panels based on cadmium telluride contain 7 tonnes of Cd per 100 MW of electrical power. They deteriorate more rapidly than crystalline silicon panels.*

TOXIC CONTAMINATING SOLAR, WIND TURBINES & BESS

****Leaching Via Weak Spots in Solar Panels**

[https://www.researchgate.net/publication/](https://www.researchgate.net/publication/348883160_Leaching_via_Weak_Spots_in_Photovoltaic_Modules)

[348883160_Leaching_via_Weak_Spots_in_Photovoltaic_Modules](https://www.researchgate.net/publication/348883160_Leaching_via_Weak_Spots_in_Photovoltaic_Modules)

"Our long-term experiments clearly demonstrate that it is possible to leach out all, or at least a large amount, of the (toxic) elements from the photovoltaic modules. It is therefore not sufficient to carry out experiments just over 24 h and to conclude on the stability and environmental impact of photovoltaic modules."

****Solar Realities - Physicist John Droz jr**

https://election-integrity.info/Energy/Solar_Energy_Concerns.pdf

We know that these are some of the toxic (some carcinogenic) chemicals that have been identified as likely being in solar panels (click on the links to get an idea of what some of the adverse health consequences are):

Per- and Polyfluoroalkyl Substances (PFAs) (also see here and here) Perfluorooctane sulphonate (PFOS)

Polytetrafluoroethylene (PTFE)

Fluorinated Ethylene (FEP)

Cadmium Telluride

Copper Indium Selenide Cadmium Gallium diselenide Copper Indium Gallium diselenide Silicon

Tetrachloride Hexafluoroethane

Polyvinyl Fluoride

Also, here is a basic explanation of the silicon manufacturing part of solar panels. The following are some additional toxic chemicals that have been identified as possibly being involved in the fabrication of solar panels, which might end up in the finished product:

Hydrogen chloride

Silicon tetrachloride

Hydrochloric acid

Sulfuric acid

Nitric acid

Sulfuric acid

Polycyclic aromatic hydrocarbons Formaldehyde

Arsine gas

Trichlorosilane gas

Silane gas

Sulfur dioxide

Sulfur hexafluoride

Sodium hydroxide

Potassium hydroxide

Lead

****Giant Hail Causes Injuries and Damage to Cars, Homes Across South-East Queensland - ABC News - 1/11/2025** <https://www.abc.net.au/news/2025-11-01/qld-thunderstorms-hit-south-east-saturday/105961034>

****South-East Queensland Lashed by Two Days of Giant Hail, with the Possibility of More Storms to Come - ABC News - 3/11/2025** <https://www.abc.net.au/news/2025-11-03/storms-giant-hail-hits-south-east-queensland-weather-bom/105963838>

****What We've Learned from the Sydney Hailstorm of 1999**

<https://www.fm.com/insights/sydney-hailstorm-1999>

Adding to the complexity, the widespread adoption of solar panels has introduced new vulnerabilities.

"Solar panels weren't being used in '99. Now they are, and they're not resilient to hail either," Hunneyball pointed out.

The future of hail risk in Australia is likely to see increasing damage due to solar panels on roofs and solar farms.

Without building resilience into this technology, the issues will persist.

****Contamination from Industrialised Solar's Galvanised Steel Supports**

<https://www.facebook.com/share/p/srbXaCbKgVXocgsm/?mibextid=xfxF2i>

"Australia is the second-most affected country by hail in the world, trailing only the United States."

"PFAS Contamination is a Serious Issue that Needs Immediate Attention"

****COMMONWEALTH PFAS BAN**

Some types have been found to be toxic to human health and the environment. In its most definitive regulatory action taken to date, the Commonwealth has effectively banned the import, use and manufacture of some of the more prominent types of PFAS (PFOS, PFOA and PFHxS) from 1 July 2025. (21 Feb 2024)

****NOTE: Chinese Solar Panels are coated in Perfluorooctane Sulfonate or Perfluorooctane Sulfonic Acid.**

****"PFOS and PFOS-related Chemicals are Still Being Produced for Regulated Uses (Primarily in China)"**

<https://greensciencepolicy.org/our-work/building-materials/pfas-in-building-materials/>

****"PFOS Chemicals are Just as Bad for Wildlife as they are for Humans.**

Tests have found that even small levels of contamination can lead to compromised immune

systems and brain asymmetry." <https://www.completehomefiltration.com.au/difference-between-pfas-and-pfos/>)

****It does not matter how much PFAS we take out of the environment if we keep on pumping them in.**

Relying on clean-ups is like bailing out a sinking boat with a teacup while the crew is busy drilling new holes in the hull.

****PFAS Remediation: Why Clean-Ups Alone Cannot Solve the Problem**

<https://chemsec.org/why-pfas-remediation-alone-cannot-solve-the-problem/>

****WINAICO's Glass-Glass Solar Modules are PFAS-Free - WINAICO Australia - 17/6/24**

<https://www.winaico.com.au/blog/winaicos-glass-glass-solar-modules-are-pfas-free> - 'in order

to reduce harmful chemicals being released

in the environment, to protect human health, ecosystems and wildlife from contamination, enable safe rainwater consumption and reduce Toxic Solar waste with a sustainable, reusable product.'

****PFAS and Other Compounds**

in Solar Panels, Wiring, and Coatings

[https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?](https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BC0A8A29D-275C-45FD-97DB-F8BA66E80800%7D)

[DocRefId=%7BC0A8A29D-275C-45FD-97DB-F8BA66E80800%7D](https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BC0A8A29D-275C-45FD-97DB-F8BA66E80800%7D)

****SAVING GREENE: Citizens For Sensible Solar**

<https://www.facebook.com/groups/CitizensForSensibleSolar/>

'Renewable energy should offer more than promises that it is good for the environment.

The solar industry promotes photovoltaic (PV) technology in the most wholesome terms: generating clean, free power from the sun.

This benevolent assessment potentially omits environmental impacts during the manufacturing, operational lifetime, and disposal of solar panels and battery storage systems.

Host towns need proof, not simply promises, when evaluating how renewable projects may affect their residents and environment, both now and in the future.

We need precedent-setting amendments to the Local Government, State & Federal Laws to prohibit using Solar Panels, Wind Turbines & BESS that "utilize or contain any amount of GenX chemicals or polyfluoroalkyl (PFAS) substances" in order to protect our essential productive Food growing land & vital Water supplies.'

****Defective or Damaged Solar Panel Recycling Mandated for 135 MW project – pv magazine**

Australia <https://www.pv-magazine-australia.com/2025/02/13/defective-or-damaged-solar-panel-recycling-mandated-for-135-mw-project/>

****Unmasking the Toxic Truth - The Solar Panel Waste Story**

https://youtu.be/_Ck2dHfIJ3s?si=0WS5CYhuCb6hNvP0

****WIND TURBINES ARE A FAKE GREEN SCOURGE - SHEDDING TONNES OF MICROPLASTICS FROM WIND TURBINE BLADES (KNOWN AS 'LEADING EDGE EROSION') - AFTER ONLY A FEW YEARS OF OPERATION.**

****Bisphenol A Pollution from Wind Turbines** - Tim Smith 13/07/2023 "Bisphenol A is the most toxic substance we know' - Swedish Environmental Protection Agency

<https://docs.wind-watch.org/Bisphenol-A-Pollution-Wind-Turbines.pdf>

****Will Bisphenol A be the PFOS of Wind Energy?**

https://www.zeeland.nl/sites/default/files/digitaalarchief/IB23_b50318e9.pdf

****Bisphenol A in Wind Turbines Damages Human Fertility**

<https://bergensia.com/bisphenol-a-in-wind-turbines-damages-human-fertility/es-human-fertility/>

****GROUND WATER SUPPLIES MUDDIED BY PILE DRIVING FOR THE MASSIVE WIND TURBINE BASES.**

*Wind farm woes continue as Victorian turbines fail after only five years – www.cairnsnews.org -

11th April 2024 <https://cairnsnews.org/2024/04/11/wind-farm-woes-continue-as-victorian-turbines-fail-after-only-five-years/>

****'Forever Chemicals' used in Lithium Ion Batteries Threaten Environment, Research Finds | Lithium-ion batteries | The Guardian 14/7/24**

<https://www.theguardian.com/technology/article/2024/jul/14/forever-chemicals-lithium-ion-batteries-environment>

****Coastal Wetland Deposition of Cathode Metals from the World's Largest Lithium-ion Battery Fire" (Moss Landing BESS FIRE)**

According to independent Experts this is actually worse than a radioactivity spill.

A lot of this very toxic stuff is not easily located. Whereas, with radioactivity, one needs just a hand-held Geiger counter to locate the pollutant.

<https://www.nature.com/articles/s41598-025-25972-8#Tab1>

****Safety of Grid Scale Lithium-ion Battery Energy Storage Systems**

"The scale of Li-ion BESS energy storage envisioned at "mega scale" energy farms is unprecedented and requires urgent review. The explosion potential and the lack of engineering standards to prevent thermal runaway may put control of "battery fires" beyond the knowledge, experience and capabilities of local Fire and Rescue Services.

BESS present special hazards to fire-fighters..."

https://www.researchgate.net/publication/352158070_Safety_of_Grid_Scale_Lithium-

ion_Battery_Energy_Storage_Systems

****Grid Scale Batteries & Fire Risk**

<https://static1.squarespace.com/static/656f411497ae14084ad8d03a/t/66fd2383b56dbc6906390297/1727865736681/Fannon-Batteries.pdf>

****Disaster at Moss Landing: The Risk of Battery Storage - YouTube - 16/1/25**

<https://www.youtube.com/watch?v=xuTaZFQA18E> ******<https://wattsupwiththat.com/2025/02/20/massive-green-battery-plant-catches-on-fire-again-weeks-after-major-toxic-blaze/>

******<https://localnewsmatters.org/2025/02/13/environmental-tests-reveal-elevated-levels-of-toxic-metals-since-moss-landing-battery-fire/>

******<https://www.sfgate.com/news/bayarea/article/environmental-tests-reveal-battery-metals-around-20163514.php>

******<https://www.cbsnews.com/sanfrancisco/news/elevated-levels-heavy-metals-elkhorn-slough-lithium-battery-facility-fire/>

****Lithium-Ion Battery Fire Risks & Extinguisher Limitations**

1.CSIRO ActivFire® Advisory Note AN-004

CSIRO explicitly states it "has not and will not certify ... that any fire extinguisher can effectively extinguish a Li-Ion battery fire."

Verification Services

****" There is a General Lack of Guidance and Provisions in Building Codes, Standards, and Legislation in Relation to Safety to Address the Potential Risks From These Technologies. Part of the problem is that we do not yet know enough about their probability of failure, their mechanisms of failure and potential consequences of failure."**

<https://www.fire.nsw.gov.au/page.php?id=940>

****NHMRC Updated Australian Drinking Water Guidelines - 25 June 2025, including:**

- revised chemical fact sheets on per- and polyfluoroalkyl substances (PFAS), selenium, lead and manganese
- an information sheet on metals and metalloids leaching from plumbing products
- a new chemical fact sheet on bismuth
- a new combined chemical fact sheet on silicon and silica
- consequential edits to the Guidelines to align advice and ensure consistency.

The Australian Drinking Water Guidelines webpage

New and revised health-based guideline values and advice has been developed for the following PFAS to reduce health risks from exposure to these chemicals in Australian drinking water:

* PFOA (perfluorooctanoic acid): 200 ng/L

* PFOS (perfluorooctane sulfonic acid): 8 ng/L

* PFHxS (perfluorohexane sulfonic acid): 30 ng/L

* PFBS (perfluorobutane sulfonic acid): 1000 ng/L

* GenX chemicals (hexafluoropropylene oxide dimer acid and its ammonium salt): no health-based guideline value can be derived at this time

PFAS Project webpage has been updated to include an overview of the PFAS review, highlighting the guideline development process, associated health risks, and other key related information.

Contact water@nhmrc.gov.au

Alan Singh

Executive Director, Research Quality and Advice National Health and Medical Research Council

****Paris Agreement** aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty.

Taking Over Farmland to Build Facilities to Produce Intermittent Energy is a Violation of Article 2, Section 1(b) of the Paris Agreement (2015).

"This Agreement... 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:

"(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**"; See: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf .

****Livestock Production Assurance Program**

The particular **Question is 2.8** of the "Food Safety on Your Property" section.

"Do livestock have access to leaking electrical transformers, capacitors, hydraulic equipment, solar panels, wind turbines, coal seam gas structures or coal mine wastes?"

- Yes

- No

- I am now aware and making plans to restrict access

<https://www.facebook.com/groups/2147446775628698/posts/2222816628091712/> https://m.facebook.com/story.php?story_fbid=2222816628091712&id=2147446775628698

****Wind Turbine Collapse in Western Victoria 'Totally Unacceptable', Engineer says - National Mining Day**

<https://www.miningday.com.au/wind-turbine-collapse-in-western-victoria-totally-unacceptable-engineer-says/>

****Worker Crushed in Fatal Incident at VESTAS Golden Plains Wind Farm in Bells Rd Rokewood, west of Geelong - ABC News**

<https://www.abc.net.au/news/2024-11-11/wind-turbine-worker-fatal-crushed-rokewood-victoria/>

104584560

****'Liberated' Serrated Parts Flying off New Wind Turbine Blades - some 750-800m from the Turbine - Golden Plains Farmer Russell Coad**

https://www.heraldsun.com.au/news/victoria/golden-plains-farmer-finds-parts-of-wind-farm-turbine-on-property/video/7937c746ac82a61259e8142313c23587fbclid=IwY2xjawF3EhhleHRuA2FlbQlxMQABHcVhQ3SlzRc33dBEZHCCN9pHBGYbWIWTRJYh_JI4aN1aPVNeQhLuXLpeQA_aem_RHnIRrtRhpmYpz3dHudmeg

****This Chinese Manufactured Wind Turbine a Veritable Pile of Junk: Questions are being asked about Material Quality and How Many More Might Simply Fall Over.**

<https:// Cairnsnews.org/2025/02/09/two-year-old-wind-turbine-in-victoria-collapses-how-unsustainable/> <https:// Cairnsnews.org/2025/02/09/two-year-old-wind-turbine-in-victoria-collapses-how-unsustainable/>

****Wind "Farm" Owner Admits Liability to Nuisance Claims - Gibbet Hill Wind Farm, Wexford, Ireland**

The case is continuing....

In 2018, the Plaintiffs sued the wind farm for nuisance and sought an injunction.

Byrne & anor v ABO Wind Ireland Ltd & ors (Approved) | [2020] IEHC 591 | High Court of Ireland | Judgment | Law | CaseMine

"Click on the full Judgement Tab"

Byrne & anor v ABO Wind Ireland Ltd & ors (Approved) | [2020] IEHC 591 | High Court of Ireland | Judgment | Law | CaseMine

ECONOMIC LICENCE HAS BEEN FORGED:

****The ISP is:-**

- Not Fit For Purpose
- An Unmitigated Disaster
- Fatally Compromised •NOT Independent •IS DEAD & BURIED! (Aidan Morrison)

****"Wind Farms in Eastern Australia - Recent Lessons" - 2012 - Electrical Engineering Expert Paul Miskelly so clearly outlining & warning policy makers more than a decade ago in his published paper:**

<https://journals.sagepub.com/doi/reader/10.1260/0958-305X.23.8.1233>

****Fancy a Model? Wait Till She Moves In - by Chris Uhlmann - 1/12/2025**

"The irony is, from the moment humanity first burned wood, we have used fossil fuels to protect ourselves from the fury of the weather.

Now, just as many warn the climate will become more extreme, we are rebuilding our entire power system on the whims of wind and sunshine.

It has the feel of an Icarus moment: a civilisation convinced it can defy gravity, only to discover the wax melts in real sunlight."

<https://chrisuhmann.substack.com/p/fancy-a-model-wait-till-she-moves>

****The 'Sunk Cost' Trickery That Makes Renewables Seem Cheaper Than They Are - 23rd July 2023.**

[https://www.fresheconomicthinking.com/p/the-sunk-cost-trickery-that-makes?](https://www.fresheconomicthinking.com/p/the-sunk-cost-trickery-that-makes?utm_medium=web)

utm_medium=web

AIDAN MORRISON

How CSIRO justifies the exclusions: "Sunk Cost"

But wait, this deception is so brazen and transparent.....

All of these tens of billions of dollars of projects are explicitly excluded from the cost of integrating renewables.

****"The Idea That Adding More & More Renewable Energy to the Grid Pushes Power Prices Down has been Comprehensively Dismissed."- 10/2/25 4:48 minutes - Aidan Morrison**

<https://www.skynews.com.au/opinion/peta-credlin/governments-insistence-on-renewables-amid-soaring-power-prices-lashed/video/86bd230860f5514d1e587239c6b913ab>

****Energy Transition Masquerade: The \$360 Billion You Pay - YouTube**

<https://www.youtube.com/watch?v=x0NKDozvO58>

****Centre for Independent Studies Zoe Hilton discusses the Liberal Party's recent move to Ditch Net Zero as well as their choice to stay in the Paris Agreement. | Sky News Australia | Facebook - 14/11/2025**

<https://www.facebook.com/SkyNewsAustralia/videos/raises-a-few-questions-liberal-party-decision-to-stay-in-paris-agreement-dispute/1158866003084976/>

NATIONAL SECURITY NIGHTMARE:

The Government has No Measures to Protect New Energy Sources from Malicious Actors!

****China-Linked Belt and Road Company Involved in Australian Net-Zero Projects Sparks Security Concerns - TA NEA - 17/10/2025**

<https://tanea.com.au/en/china-linked-belt-and-road-company-involved-in-australian-net-zero-projects-sparks-security-concerns/>

****China's Energy Dream - Patricia Adams**

"Carbon dioxide reduction only makes sense for those China wishes to harm & supplant."

<https://www.thegwpf.org/content/uploads/2021/12/Adams-Chinas-Energy-Dream.pdf>

****Chinese Hackers are Determined to 'Wreak Havoc' on U.S. Critical Infrastructure, FBI**

Director Wray Warns | PBS News - 2024

<https://www.pbs.org/newshour/politics/chinese-hackers-are-determined-to-wreak-havoc-on-u-s-critical-infrastructure-fbi-director-wray-warns>

****Hacked Off: CyberCriminals Attack Rooftop Solar To Bring Down Entire Grid**

<https://stopthesethings.com/2024/09/07/hacked-off-cybercrims-attack-rooftop-solar-to-bring-down-entire-grid/> <https://stopthesethings.com/2024/09/07/hacked-off-cybercrims-attack-rooftop-solar-to-bring-down-entire-grid/>

Communist China is setting us up for solar panel-based disaster:

"Solar panels that make the electricity suitable for the power grid and which are usually connected to the web, can be "easily hacked, remotely disabled or used for DDoS [Distributed Denial of Service] attacks." DDoS is one of the most common types of attacks, which basically try to overwhelm a system... Solar panels were outlined as a vulnerability in several scenarios, also due to the dominance of a single country, China, in the supply chain."

"Traditionally, cyber risk with solar inverters was low because they were not connected to the internet," said Falk. "However, as the popularity of smart home energy systems has boomed, this has changed, with most solar inverters now web connected."

****Rogue Communication Devices Found in Chinese Inverters**

<https://www.reuters.com/sustainability/climate-energy/ghost-machine-rogue-communication-devices-found-chinese-inverters-2025-05-14/>

****Beautifully Hackable - Irina Slav on Energy - 12/8/24**

https://irinaslav.substack.com/p/beautifully-hackable?utm_campaign=email-post&utm_source=substack

****U.S Blacklists Chinese Battery Giant**

"These batteries are used in electric vehicles here in Australia," Mr Danby said.

<https://www.skynews.com.au/opinion/us-military-is-concerned-america-blacklists-chinese-battery-giant-over-military-links/video/765e12fec5e3b837a5e606e40371a7f9>

****China's Sinister Solar Panels and the Plan to Black Out the World! - YouTube - 13:44 minutes**

<https://www.youtube.com/watch?v=aqL0s18HXbY>

****Australia's Climate Ambitions have a Modern Slavery Problem - ASPI Editors' picks for 2024:**

'Examining the Origins of our Big Batteries' aspistrategist.org.au [https://](https://www.aspistrategist.org.au)

www.aspistrategist.org.au/editors-picks-for-2024-australias-climate-ambitions-have-a-modern-slavery-problem-examining-the-origins-of-our-big-batteries/

****China's Dirty Secret - The Real Reason Why Tofu Dregs are Collapsing! - YouTube**

<https://www.youtube.com/watch?v=5GIBadLZ17E&pp=0gcJCf8Ao7VqN5tD>

****Aussie Expert's Chilling Chinese EV Warning**

<https://www.news.com.au/technology/motoring/on-the-road/china-could-make-evs-explode-cyber-expert-warns/news-story/2d29b6e3474d85dc64e8bdcb0995fbec>

****CCP-tied Group is Quietly Fueling US-Based Climate Initiatives: Tax Filings 'Environmentalists Fueled by China are Promoting Policies that Would Increase our Dependence on China'**

<https://www.foxnews.com/politics/ccp-tied-group-quietly-fueling-us-based-climate-initiatives-tax-filings>

DODGY TransGrid & DELIBERATE FAILURE of AUSTRALIAN BATTERY MAKER:

****Transgrid: Alleged Breaches of the National Electricity Rules | Australian Energy Regulator (AER)**

<https://www.aer.gov.au/publications/reports/compliance/transgrid-alleged-breaches-national-electricity-rules>

****Notice of Dispute of Transgrid's RIT-T for Meeting System Strength Requirements in NSW | Australian Energy Regulator (AER) - 13/8/2025**

<https://www.aer.gov.au/documents/cis-notice-dispute-transgrids-rit-t-meeting-system-strength-requirements-nsw>

****Crying Shame Inside the Demise of Australia's Only Battery Maker**

<https://www.afr.com/companies/energy/crying-shame-inside-the-demise-of-australia-s-only-battery-maker-20250901-p5mrl4>

Storage requirement for 100 percent Renewables on the Eastern Australian Grid

Executive Summary - Notes for policymakers

BESS Batteries are NOT generators

In the present unseemingly, mad, rush in Australia to introduce what looks to be the latest and greatest in renewables and associated technologies, policymakers seem to have forgotten that batteries, whether utility-scale BESS batteries, or otherwise, are batteries. They are NOT and never will be generators. They cannot replace fossil-fuelled generators, even when symbolically placed on the same site as a decommissioned fossil-fuelled power plant.

Like any other battery, once its stored charge has been used, a BESS has to be recharged from a generator. Tellingly, BESS were never required to support a grid powered by fully dispatchable generators. These batteries are required only because generators such as wind and solar generators are by their very nature, non-dispatchable, highly-variable-output, unpredictable, intermittent generators. That is, these batteries are required as a “band-aid” to deal with the very real deficiencies of these so-called “renewable” forms of generation.

As the sole purpose of a BESS is that of acting as a ‘band-aid’ to wind and solar generators, it should be seen as a very necessary item of ancillary equipment, and as such, should NOT be seen as an item which would attract any form of “renewables” subsidy. Furthermore, the very real, very large CO₂ emissions embedded in the production of any BESS should be counted against any supposed emissions reductions that might be achieved by the “renewable” generator that it is alleged that it is being used to support.

Preamble

As stated in the Conclusions below:

It would seem that Australian government authorities have either not performed and/or have not made publicly available any analysis that provides any indication whatsoever, in a readily understandable way, how many “Big Batteries” will be required in Eastern Australia to meet the proposed 100-percent Renewables’ Storage requirement; how these Big Batteries will be sourced and paid for, what are the energy requirements for their production, what safety procedures have been put in place given the known fire risk from these battery technologies, what waste disposal procedures, if any, are envisaged, and the CO₂ emissions resulting therefrom, and, importantly, where these batteries are to be sited, and, given their relatively short service life, how they are to be recycled and re-used.

It beggars belief that none of this absolutely necessary preliminary, investigative work seems to have been addressed by the relevant Australian Planning Authorities.

Clearly, these Authorities perceive that this Battery Storage requirement is merely a minor matter.

To, the contrary, this analysis finds that the Battery Storage requirement is very much a matter that has grave consequences, both for the Eastern Australian Grid, and for the National Economy - hardly a minor matter.

Summary of Findings

In summary, the findings of this analysis are:

From an analysis based on the AEMO Generator and Operational Demand data for the full period of the calendar years 2023-2024, to even begin to consider a 100-percent Renewables scenario for the Eastern Australian Grid:

1. The present wind and solar energy facilities complement will need to be increased, as a minimum, by a factor of 3.31.
2. The minimum Storage Requirement to provide coverage during the worst extreme, prolonged minima in output of the renewables, must be able to supply the full Demand for a minimum period of 41.1 days. This translates to a Storage Requirement of 20,625,000 MWh, equivalent to some 45,833 Geelong Big Batteries, or some 159,884 Hornsdale Big Batteries.

Clearly, this Battery Storage requirement is unachievable. That it is so has the potential for dire consequences should it continue to be pursued. As a result, in their pursuit of a 100-percent renewables electricity generation target, policymakers need to understand very clearly that should this storage requirement not be fully completed, that is, at the outset of any proposed closure of dispatchable fossil-fuelled generation, a permanent regime of frequent, unpredictable, widespread blackouts is the only possible outcome.

Also, policymakers need to bear, again very clearly in mind, that with the closure of fossil-fuelled generation, it is absolutely essential that the consequent loss of synchronous inertia be replaced by a reliable, proven, available-at-all-times “grid-firming” substitute. If it is envisaged that this is to be somehow managed with battery storage, this merely adds to the onerous battery storage requirement already identified in this analysis.

If these matters are not addressed then the twin effects of the resulting social disruption, and the impact on the Australian economy, of an ongoing regime of widespread electricity blackouts, do not bear thinking about.

Estimated Cost of the necessary battery storage as a proportion of annual GDP

At a cost of some \$USD200/kWh, (Menton, F., *pers. comm*). the cost of this storage comes to some \$USD4.125 trillion. For comparison, Australia’s total GDP at the end of 2025 is estimated as \$USD1.818 trillion¹ So the total battery storage cost is estimated as being some 2.27 times Australia’s GDP for calendar year 2025.

Clearly, any proposed buildout of battery storage on this scale is unattainable.

Land take

According to: <https://victorianbigbattery.com.au/faqs/> , the Geelong battery covers an area of the same size as the Geelong Kardinia Park GMHBA Stadium field. This is an area of some 2 hectares.

There does seem to be some disagreement as to the size of the area occupied. According to the link <https://moorabool.com.au/faqs/>, the battery occupies some 4 hectares. I have used the 2 hectare figure in the following calculations.

¹Source: <https://www.worldeconomics.com/GDP/Australia.aspx>

Some 46,000 Geelong Big Batteries would occupy an area, a minimum area, of some 92,000 hectares. This does not include the area required for the corridors for the necessary connecting transmission lines. It is clear that government policy is to acquire rural lands for this purpose, rural lands which are predominantly farmland, that is, land used for food production. This makes it a very significant land grab. This land take is in addition to the considerable amount required for the additional wind and solar “farms”, each of which itself constitutes a very significant land grab.

Taking over farmland to build facilities to produce intermittent energy is a violation of Article 2, Section 1(b) of the Paris Agreement (2015).

Article 2 1(b) of the 2015 Paris Agreement states:

“This Agreement... 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:

*“(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**”*; See: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf .

Policymakers need to understand, and to understand very clearly, that these storage batteries are merely a band-aid; they would not be necessary except for very serious shortcomings in the forms of generation – the intermittent renewables - that these batteries are required to support.

A battery does NOT extract energy from the wind or the sunshine. These batteries are required simply because both solar and wind generation are highly intermittent forms of generation and these forms of intermittent generation have a major failing: neither is dispatchable. These forms of generation are also incapable, unlike conventional generation, of providing, automatically, at all times the very necessary synchronous inertia required for grid system security. The batteries would not be required if these forms of generation were a plug-in replacement for real, conventional generation.

The batteries then are a necessary ‘band-aid’. That they are required as a band-aid does not justify the requirement for the vast land-grab that will result from their use. The battery unit itself is NOT a “renewable”, or any other form of, generator.

Also, policymakers need to understand, for this renewables plus battery storage scenario to even begin to be a feasible option:

1. that the battery storage cannot simply be added incrementally over a period of time from some low starting value. It must be available as the amount as stated, that is, 12,077,136 MWh minimum, and it must be fully charged at the time of switch-over to 100-percent renewables.
2. that the renewables complement must be at the level as stated before shutting down any of the remaining dispatchable generation.

Attempting to shut down existing dispatchable, fossil-fuelled generation before the above capacity requirements are met, in full, will merely lead to frequent, unpredictable, widespread blackouts.

Policymakers also need to consider the following:

1. Neither the required units of renewable generation nor the battery storage units “grow on trees” or “pop out of thin air”. At present, all such units are fully imported, increasingly from suppliers whose intentions toward Australia are recognised by Australia’s Security Services as being rather less than benign. At any time, these suppliers could impose a trade embargo on the supply of this equipment, instantly posing a profound risk to National Security. See also Wilson (2023).
2. Each Geelong-scale Big Battery will occupy the space, involve the land take, as quoted above, of an AFL football stadium, and then some. Where and how are some 46,000 Geelong Big Battery equivalents going to be sited?
3. What considerations have been given to the transmission line requirements to connect so many of these grid-scale batteries to the Eastern Australian Grid?
4. Where are these grid-scale batteries to be manufactured? What amount of CO₂-producing fossil-fuels will be required to mine the ore, extract, refine and manufacture, the enormous number of battery modules required?
5. Given the massive scale of the battery requirement, and the known probability of risk of fire, the provision and cost thereof of permanent firefighting facilities and staff, similarly on a massive scale, must be factored into the operations of these battery storage units.

Exclusions from this analysis

The requirement to replace the Synchronous Inertia automatically provided by conventional, fossil-fuelled generation has been mentioned in the Executive Summary. However, any Battery Storage Requirement to address this need is not the subject of this analysis. That is, any Battery Requirement to supply such as the “Grid-firming” or “Synthetic Inertia” substitute for the Synchronous Inertia requirement is in addition to the storage requirement identified here.

To give some indication of the battery storage requirement for grid-firming, the AEMO (2024, pp. 12) has identified a need for some 49 GW/646 GWh of firming storage, as part of a total of 75 GW (AEMO, *ibid.*, pp. 73). Using this AEMO estimate as a guide, the figure of 646 GWh corresponds to some 1437 Geelong Big Batteries. This requirement is in addition to the findings determined by the analysis discussed here, which is the long-term storage requirement alone.

Ashworth & Pashajavid (2025) provide a useful primer on the concept of “grid-firming”. A paper prepared for Transgrid (2024) provides a very comprehensive technical review of the state of development of grid-firming technologies. What is very clear from this paper is that:

- The battery systems used for grid-firming are considerably more expensive than those grid-scale BESS systems used for energy storage;
- It is by no means the case that the grid-firming technology that is presently available can be regarded as reliable and system-ready. See: “Table 7-1: Comparison of synchronous generators and GFM inverters from a grid-support standpoint”, (Transgrid, *ibid.*) for a useful summary of the present state-of-the-art of Grid-Firming technologies.

Introduction

Menton (2022), addresses the battery storage problem in a readily-understandable paper. He states: “Remarkably, none of the jurisdictions currently embarked on crash programs to implement Net Zero through wind and solar facilities has paid much attention to the energy storage problem. All appear to assume that one only needs to build enough wind turbines and solar arrays, and perhaps a few batteries of unspecified amounts along the way, and the fossil fuel facilities can just gradually be retired and emissions will fade away. As we will see, the energy storage problem is enormous, it is critical, and it is far from being solved.”

Subsequently, Menton (2023) , discusses a scholarly paper by a certain Balazs Fekete and colleagues (Fekete B *et al.*, 2023), and a blog post article by Fekete himself (2023), discussing their experiences in getting the paper published. In the paper, Fekete *et al (ibid.)* concluded, for the fairly large region of the US that they considered, comprising 18 adjoining northeastern States, that a value of storage, equivalent to some 25 percent of the total annual demand for that region, is the minimum requirement. On an average demand basis, this 25 percent is equivalent to some 91.25 days of demand.

Putting that into the Eastern Australian context, 25 percent of annual demand for the year 2023, based firmly on AEMO operational data, this being some 20,970 MW (the average annual demand for 2023), times 24 hours/day times 365 days/year times 25 percent, or, 45,924,300 MWh.

To put that number into some sort of real item of equipment, that is the equivalent of 102,054 Geelong Big Batteries. (The Geelong BB has a stated storage capacity of 450 MWh.)

Clearly, these are enormous numbers, implying an enormous and unprecedented infrastructure requirement, the like of which has never been attempted in Australia, if indeed anywhere.

To seek to put the likely requirement into the context of the Eastern Australian grid, I thought to apply the analytical method described by Fekete *et al (ibid.)* to the Eastern Australian grid, where, instead of having to deduce likely electricity generation performance from regional wind behaviour and solar irradiance characteristics, as Fekete *et al (ibid.)* were, it seems, required to do, presumably because they did not have access to electricity performance data for their region, I could use directly the publicly-available, actual AEMO-supplied operational data, thus hopefully removing a significant source of uncertainty in the results from the analysis.

The first step was to sub-total, respectively, the hydro, wind farm, and solar farm data, from the AEMO’s NEMWEB site at every 5-minute timepoint from the years 2023, 2024, Dispatch_SCADA data. I also collected the AEMO’s Operational Demand and estimated Rooftop PV data for 2023-4. Each of these latter datasets is supplied at 30-minute timepoints, so I presumed to interpolate these values to the intermediate 5-minute timepoints. This approach allowed the use of the Fekete *et al (ibid.)*. methodology at every 5-minute timepoint.

Note: I did not include pumped-hydro in the hydro subtotals. At present, the operators of pumped-hydro plants are not constrained to purchase the pumping component from renewables’ sources, so I have presumed that these sources provide what is essentially delayed fossil-fuel generation.

Methodology

Essentially, as I understand it, the Fekete *et al* (*ibid.*) methodology is applied in the following way:

- (a) At the first, or earliest, timepoint in the series of interest, sum the renewables' subtotals (MW), subtract the corresponding demand (MW), the result is the deficit/surplus value at that timepoint.
- (b) Convert this deficit/surplus value to MWh, noting that the time period is 5 minutes, and store it as the accumulated deficit/surplus.
- (c) Repeat at the next timepoint, but for this, and successive timepoints, add the surplus/deficit from each previous timepoint. (Where it is understood that to "add" is an algebraic addition: a deficit carries a minus sign, so, "adding" a deficit value is essentially subtracting it).
- (d) Continue in this fashion, recording the deficit/surplus value at each timepoint, and accumulating a total deficit/surplus value across the entire time span of the operational data.

This process, as Menton (*ibid.*) observes, is very similar to the procedures used in normal financial profit and loss accounting. It is important to mention "deficits" because, at present, given that the renewables capacity on the Eastern Australian grid is still far short of being able to supply the present demand requirement, running this accumulation process with the current values of the renewables' subtotals quickly results in a very large, negative value, that is, a large deficit, and hence a failure to supply sufficient generation to meet demand.

Before attempting the analysis, it is useful to attempt to place limits on the various likely values, where that is possible. For example, what might be the maximum possible value of the Required Storage, presuming the absolute worst-case conditions?

As the lower limit, the Required Storage cannot be less than zero.

Presumably, the absolute maximum value might be that required to meet one year's Demand. (It may safely be presumed that having all forms of generation shut down for more than a year, which is what this value implies, would be deemed to be totally unacceptable.)

This value is readily determined: Average Demand (MW) times 24 hours times 365 days per year, Inserting the value for Average Demand for calendar years 2023-2024 in the equation:

20966.7409399774 MW times 24 times 365 MWh per year, resulting in a value for the upper limit of the maximum Required Storage of: 183,668,651 MWh (per year).

The range for the value of the Required Storage that would meet the variations in the Total Demand during one year, must lie somewhere within the range: [0 - 183,668,651] MWh.

To attempt to study what would be a likely 100 percent renewables configuration, I thought to run a number of different scenarios where, in each, in turn, I multiply the present wind and solar sub-totals by a positive number, starting at two, and then calculate the accumulation for the entire period (all 5-minute time points for 2023-2024). If that multiplier produces a negative value for the running total of the accumulation – signifying a blackout - then increase that multiplier number and repeat the deficit/surplus calculation for the entire period. Repeat as necessary, increasing the multiplier for each scenario attempted until an overall surplus – no negative values in the running accumulation - results. To give some sort of context, the first, the "multiply-by-two" scenario is equivalent, to a first approximation, to doubling the installed wind and solar farm capacity. Unsurprisingly, this scenario also results in a large deficit, but it is not as large as the first case.

Note: in devising this strategy, I chose not to use multipliers on the Hydro and Rooftop PV subtotals for the following reasons:

- i. given community attitudes regarding hydro dams, it is extremely unlikely that there will be a significant increase in hydro capacity in the foreseeable future,
- ii. Rooftop PV capacity is already so large that it is straining grid stability limits in the middle of the day on almost every day, so it is extremely unlikely that even a doubling of capacity, for example, would continue to be actively encouraged by government policy. (Also, the figures provided by the AEMO for Rooftop PV performance are an estimate only.)

In an earlier version of this work, I sought to commence the stepwise process with a Storage of zero, hoping to build it up over time to some sort of steady-state by starting with a sufficiently large multiplier of the current renewables' generation portfolio.

It soon became apparent that this methodology failed, in that a very large initial portfolio of renewables-only generation was required, resulting in the situation that, without reducing the multiplier over time, the amount in storage just kept increasing monotonically.

I thought to look at other possibilities, first doing a search of the hydrology literature on such as: "sizing reservoir storage to match demand". I found the following, potentially useful, link:

["https://engineeringnotes.com/water-engineering-2/storage-reservoir/how-to-determine-capacity-of-a-storage-reservoir"](https://engineeringnotes.com/water-engineering-2/storage-reservoir/how-to-determine-capacity-of-a-storage-reservoir)

Two methods were described, the second being what is called the "Mass Curve method". What became clear here was that, in order to determine the required storage, in any run, the initial storage in the reservoir must be such that, on commencing the march through the timesteps during, for example, one calendar year of 5-minute timesteps, the reservoir must be at full capacity.

A first step to a "Real" Battery Scenario

As it is of absolute importance to obtain the best estimate of the storage requirement, I thought to give due consideration to the very real losses in using battery storage. As a first step to including these losses in any practical battery storage configuration, I thought, from the outset, to consider the case of the "non-ideal" battery. In a recent email citing a paper at:

<https://www.windtaskforce.org/profiles/blogs/battery-system-capital-costs-losses-and-aging>, Post (2019) cites the following recommendation from Tesla, the manufacturer of the Hornsdale "Big Battery" in South Australia, that to maximise battery life:

"The 40% throughput is close to Tesla's recommendation of 60% maximum throughput, i.e., not charging above 80% full and not discharging below 20% full, to achieve a 15-y[ear] life, with normal aging". See also Post (*ibid.*) for a comprehensive discussion of grid-scale battery losses. In determining the accumulating storage then, I needed, at the very least, to ensure that at all times that:

- the resulting value for the Required Storage was set at 1.25 times the maximum accumulating storage, (thus ensuring that the accumulating storage never exceeded the battery manufacturer's requirement that 80 percent of the actual storage is never exceeded),
- at any time point, the amount of the storage component available to calculating the deficit/surplus was never such that the residual in the battery storage was permitted to fall below the stipulated 20 percent of the current Required Storage capacity.

What became clear from the use of the hydrologist's methods is that any iterative attempt at predicting the required storage must presume that the chosen storage is at full capacity at the commencement of the iterative procedure.

Also, it seemed sensible to chose an initial value for the multiplier/s such that the average value of the total available renewables-supplied generation, (that is, wind plus solar far plus Rooftop PV plus

hydro), is equal to, or just slightly greater than, the average demand for the period under consideration, here the calendar years 2023-2024.

Results

In summary, after trialling many iterations using different multiplier values on the present respective wind and solar installed capacities, I found that the multiplier 3.31, applied to both these current wind farm and solar farm complements, was the minimum required to enable the mix to meet the present demand. The use of this generation mix resulted in a storage requirement equivalent to 41.1 days of average demand. This requirement, remembering that the total storage required is 1.25 times the actual storage required to balance the demand, (given that the storage may be filled to no more than 80 percent of capacity), came to some 20,625,000 MWh. This then is the storage required to be able to balance demand at all times throughout calendar years 2023-2024.

Giving some sort of context to what this bare number, some 20,625 GWh, means:

it corresponds to 45,833 Geelong Big Batteries, or, 159,884 Hornsdale Big Batteries.

It is useful to compare the latter with an estimate by Paul McArdle, CEO of Global-ROAM Consulting), which I understand is some 70,000-80,000 Hornsdale Big Batteries (Moran, A., *pers. comm.*). But I further understand that Mr McArdle presumed, as a reasonable first approximation to obtaining a ball-park figure, that the batteries are “ideal”; that is, he did not attempt to address such practicalities as, available storage vs the required storage, transmission losses, two-way trip losses, redundancy required based on battery failure frequency, etc. According to Post (*ibid.*), the Hornsdale Big Battery has a storage capacity of 129 MWh.

The inclusion of any of these many other very real sources of energy losses in the round-trip from generation of surplus through to battery storage to subsequent supply to meet the demand at those times when there is a deficit in the renewables’ output merely increases the required battery storage.

There are several, extremely serious, implications resulting from these findings.

1. Impact on CO₂ emissions reductions calculations – the Embedded Emissions

With this vast requirement of some 46,000 “Geelong Big Batteries”, there is a clear requirement on the authorities that they determine an accurate estimate of the CO₂ emissions resulting from the mining, milling, refining, manufacture of the colossal amounts of materials required for the production, transport and site preparation for this huge number of required “Big Batteries”. That the resulting CO₂ emissions might occur in countries outside of Australia does not excuse the requirement for the necessary accounting. It does not matter what is the site of their release, any resulting CO₂ emissions are being released into the Earth’s atmosphere.

2. Recycling Burden

Any realistic estimate gives a battery lifetime of some 10-15 years at most. How will it be possible to develop efficient, both in materials and energy efficiency, and effective, recycling and re-use regimes to process such horrendous quantities of waste battery materials? Uttering pious words that “a circular economy will be developed” with no thought as to the detail, as NSW Planning, for example, is doing at the present time, is merely a strategy of leaving the resolution of these horrendous problems to future generations. For a realistic estimate as to the extent of the waste disposal issue, see Mills (2020).

3. Environmental Impacts

Given that the Geelong “Big Battery” requires a land-take that is at least equivalent to that of one of Victoria’s Australian Rules Football Stadiums, there is an urgent need to address the likely environmental impacts of what is, by any estimation, a huge land-take requirement. Also worth emphasising is that there can be no argument as to land-use of the land-take required for a BESS. These behmoths occupy the entirety of the land on which they are constructed. There is also the land take required for the enormous amount of overburden and waste rock generated by the mining and milling operations required in the winning of the necessary materials required for the batteries. Again, see Mills (*ibid.*).

4. Fire Risk

At present, various EIS reports for BESS proposals usually emphasise the risk of fire damage TO the proposed BESS facility from bushfires. There seems to be no account taken of the likely damage to the vicinity of any BESS resulting from fires that start within the facility itself. That there is a very real risk of fires starting in these facilities during, say, a fast-charging scenario, seems at present to be almost totally ignored in these proposals. That there is such a very real risk is indicated by the high rate of fires occurring in domestic premises resulting from the presence of active, in-use batteries of the same Lithium-Ion technology. To think that such a level of risk can be ignored when of the order of 46,000 Geelong Big Batteries is the requirement, is simply fanciful.

5. National Security Concerns

As each of these “Big Battery” installations takes up a huge area, poses a significant fire risk due to the Lithium-ion technology used, and that there will be potentially so many of them, these big batteries constitute a very real National Security risk. It is not inconceivable that a determined aggressor, using something as simple as a concerted drone attack, could set out to destroy these installations, resulting in Eastern Australia a firestorm that would make, for example, the fire-bombing of Dresden during WWII, look like a village bonfire in comparison. That a grid-wide blackout resulting in the total paralysis nationally for some weeks would be the inevitable result of such an attack seems to be an almost incidental consequence. There is also the very real risk that a cyber attack on any potential “back-door”, built in by foreign suppliers, could be used to shut down the batteries instantly, at any time, producing widespread blackouts. Why have governments seemingly given no thought to the likelihood of such a scenario? See, for example, Prins *et al* (2024) for a UK perspective of the likely devastating impacts on National Security that so-called “Net Zero” policies are already causing and increasingly will have in Britain. For the Australian context and perspective, the excellent paper by Wilson (*ibid.*) is recommended unreservedly. This paper not only discusses the, entirely negative, impacts of the present policies supporting renewables in Australia, it also provides a foundational basis for the meaning of Energy Security.

Conclusions

This initial analysis indicates that something of the order of the equivalent of some 46,000 Geelong “Big Batteries” will be required to even begin to address the storage requirements of a 100-percent Renewables scenario for the Eastern Australian grid at present electricity Demand requirements.

This is the amount of storage required to support what I think is a minimum complement of renewable generation that might replace the dispatchable, fossil-fuelled, generation fleet. The complement that I have chosen is some 3.31 times each of the present solar and wind farm fleets, plus the present hydro and rooftop solar complements.

I emphasise that the chosen combination is by no means the “only” one that might be used – many different combinations might be chosen. Cost considerations, might well suggest a different mix.

What has become clear is that, for example, if the desire is to reduce this massive amount of required storage, then a mix that is a massive overbuild of solar and/or wind generation might be used, but this would result in long periods of curtailment,-hence loss of potential income - something that might not be attractive to potential developers.

This figure of 46,000 does NOT address the round-trip losses necessarily resulting from the generation, storage, and later release of electrical energy from that storage. Accounting for these very real losses would merely increase the required battery storage figure.

This number of “Big Batteries” resulting from this very preliminary stage of my investigation indicates the requirement for some very serious investigative work, as a matter of extreme urgency, by those in authority who are presently forging ahead with the “100-percent Renewables plus Battery Storage” policies.

It is instructive, I think, to quote from the paper of Fekete *et al (ibid.)*, where they summarise the outcome of their extensive literature search on the topic of the need for the requirement for backup and/or storage to support intermittent renewable generation:

“Perhaps the most disturbing statement was “Many studies suggest that large (>50%) CO₂ emission reductions will not be possible without carbon capture and sequestration (CCS)” (Loftus et al., 2015; Craig et al., 2017) citing the “Deep Decarbonization Project” (<https://ddpinitiative.org>). If this is a prevailing sentiment among researchers studying the viability of transitioning the energy sector to renewables, one would wish that they were louder and clearer several decades and trillions of dollar investments ago and informed the public that renewables are not sustainable since they will always require the assistance of fossil fuels.”

Similarly, as far as I am able to determine, no relevant Australian government authority has performed and made publicly available any analysis that provides any indication whatsoever, in a readily understandable way, such as how many “Big Batteries” will be required in Eastern Australia, how they will be sourced and paid for, what are the energy requirements for their production, the waste disposal and CO₂ emissions resulting therefrom, where these batteries will be sited, and, given their relatively short service life, how they will be recycled and re-used.

It beggars belief that none of this absolutely necessary preliminary, investigative work seems to have been addressed by the relevant Australian Planning Authorities.

Pursuing the grand dream of “Renewable Energy Superpower” for Australia is, to quote Mills (*ibid.*), “*an exercise in magical thinking*”. Given that electricity prices continue to spiral ever upwards², as a result of the ever-increasing level of subsidy payments to the ever-increasing fleets of so-called “renewables” and BESS storage; and the now looming threat of widespread, frequent blackouts; it is time that governments abandoned this nonsensical policy.

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²See, for example, a recent report: Cranston M 2025 *A survey of more than 500 Australian companies has found energy costs have become the top business challenge*. The Australian, 3 October 2025. Available at: <https://www.theaustralian.com.au/business/a-survey-of-more-than-500-australian-companies-has-found-energy-costs-have-become-the-top-business-challenge/news-story/be7c2e1efbf7034fc78456dcab357b3b>

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Appendix – Comparison with Case Studies by Others

First scenario

In a recent post at: <https://joannenova.com.au/2025/09/monday-124/>, contributor Willoughby, (pseudonym “RickWill”), at comment #21.1.1.1 cited a paper, Willoughby (2017)³, in which he had obtained for a figure of 250 GW installed solar generation, (as stated in the paper, this represents a massive overbuild of generation capacity), a requirement of some 750 GWh of storage.

I thought it would be useful to attempt to recreate this scenario using the Fekete *et al* (2023) methodology described here.

In the paper cited at the first post above, Willoughby assumes the use of an ideal battery. That is clear from the several figures in the paper as the battery discharge/charge characteristics are shown as going from the full 100-percent charge state to 0-percent discharge state.

I thought to run this scenario staying with the use of a non-ideal battery as I believe that this is a better reflection of reality. Interestingly, and perhaps surprisingly, for an installed solar capacity of 250 GW, the Fekete *et al* (2023) analysis methodology yields a battery storage requirement of 987 GWh. Given that this is for the use of a non-ideal battery, where the battery state of charge may never exceed 80-percent of battery capacity, nor drop below 20-percent capacity, this figure of 987 GWh can be considered to be comparable to the Willoughby (*ibid.*) figure. (A non-ideal battery requires a significantly higher total capacity in order that the charge swing between the permitted 80-20-percent limits is sufficient to give the required storage.)

In addition, I thought it might be useful to determine the required storage for a range of values below the cited 250 GW installed solar capacity proposed by Willoughby (*ibid.*) to see how the required storage might vary with a given installed capacity. The following table shows the results.

Installed Capacity (GW)	Required Storage (GWh)
80	26735
96	14750
120	6213
140	2538
160	1725
200	1375
250	987

As can be seen from the table, the required storage rises dramatically as the installed solar capacity is reduced. The required storage value of 26735 GWh listed in the table for the lowest installed capacity figure of 80 GW compares favourably with the value of 20625 GWh which I found for the mixed generation scenario discussed in the analysis in this paper, remembering that, similarly, this figure of 80 GW is a much lower overbuild in installed generation capacity.

³Willoughby 2017 *Meeting Unscheduled Demand with Intermittent Generation – Submission to the Independent Review into the Future Security of The National Electricity Market* 19 February 2017. Available at: <https://www.environment.gov.au/submissions/nem-review/willoughby.pdf>

Second scenario

Subsequently, at:

<https://joannenova.com.au/2025/10/trump-goes-gangbusters-on-beautiful-clean-coal-more-land-more-mines-and-625m-to-reopen-old-plants/>, at comment #9, Willoughby cites a quotation from a wind farm developer which states:

“The Australian Government has set a 2035 emissions reduction target at 62–70% below 2005 levels. Hitting this target will require a massive scale-up of renewables: 4x wind capacity, 3x utility solar, 2x rooftop and distributed solar, and 6x utility-scale storage.”

As this is a quote from a wind farm developer, it deserves little credence. However it is useful to run the analysis using the multipliers cited, noting that as at 30 September 2025, it is reported that there is some 6,591.5 GWh installed BESS capacity on the Eastern Australian Grid⁴

Running this particular scenario gives a storage requirement of some 12,640 GWh, which is some 1915 times the presently-installed BESS storage; a figure that is rather more than the “6x present utility-scale storage” capacity as quoted above.

This second result does rather confirm the view expressed at the outset that government authorities in Australia have yet to do any sort of serious analysis as to what mix of generation and storage would be required on a renewables plus storage -dominated Eastern Australian Grid.

⁴Heynes G 2025 *Australia’s NEM battery storage surpasses 6.5GWh milestone in week*. September 2025. Available at: <https://www.energy-storage.news/australias-nem-battery-storage-surpasses-6-5gwh-milestone-in-weekend-of-records/>