

SOS submission to IPCN re Glenellen Solar Works

Independent Planning Commission NSW

Glenellen Solar Works SSD-9550 200MW solar generator

[Independent Planning Commission - Glenellen Solar Farm \(nsw.gov.au\)](https://www.nsw.gov.au/independent-planning-commission-glenellen-solar-farm)

Submission from Save Our Surroundings 23 November 2023

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Dear Commission

Introduction

Further to our verbal submission at the 16/11/23 public meeting we herein provide a more detailed written submission of our objections to the proposed Glenellen Solar Works. As part of our submission we include our attachment "Wind and Solar Electricity Generation Are the Answer. Seriously? November 2022"

Members of SOS and many other community groups, already live with the negative consequences of Australia's emissions reductions fever. Every advisory body, wind and solar Development Application and Environmental Impact Statement, climate related legislation, company reports, etc. we have read use the mandatory reduction of CO2 emissions as justification for destroying the natural surroundings and peoples' lives both in Australia and Overseas. Yet negative consequences, which actually work against the reduction of greenhouse emissions, are largely ignored despite the objections of the impacted communities.

We all love the environment we chose to live and work in but we are seeing it destroyed piece by piece across our agricultural and wildlife lands. It is heart-breaking for many communities who not only suffer from such developments like the proposed Glenellen Solar Works to their environment, but also the division the planning process causes in the communities.

The planning processes, as for Glenellen Solar, go on for years and overlaps with numerous other proposed projects and inquiries. Each project has significant impact on each community. The cumulative number of projects in the same geographic region, such as around the beautiful agricultural region in the Greater Hume area, will have long-term consequences, including regional cultural change, division within communities, loss of amenity, loss of local wildlife (endangered or not), loss of access to already limited and inferior services, loss of agricultural activity, loss of tourism, conflict within families and between friends and neighbours. Such consequences will continue for the regions for decades and be repeated every 20 or so years as replacement solar and wind projects are proposed.

We now have a few years of Australian experience with the claims made before approval verses the realities after approval of solar, wind, BESS and pumped-hydro projects.

Yet the DPE "...considers the project would not result in any significant impacts on the local community or the environment, and any residual impacts can be managed through the implementation of the recommended conditions."

Many more of these massive industrial developments are being constructed or under consideration within a few kilometres of Jindera and other regional towns. Despite the enormous amount of land involved and materials consumed, all these renewables works will only produce electricity on average less than 30% of the time when new. On the cloudiest day a solar works will produce less than 10% of its rated capacity. This reflects the very low capacity factor associated with solar and wind projects.

Mandated net zero emissions targets, along the lines already seen in the electricity generation industry, become almost the sole justification for ignoring the many negative consequences that are the reality of ignorance. Many of these consequences are covered in the attachment "Wind and Solar Electricity Generation Are the Answer. Seriously?"

In this submission we will raise significant issues we have with the Glenellen Solar Works proposal and the DPE's Assessment Report. Even then the issues covered will only reflect a small amount of both our extensive research and personal experiences of various members of the impacted communities, especially in relation to weather-dependent renewables and the planning process. Appendix A gives some examples of what Proponents of solar projects would otherwise have gotten away with and the DPE failed to identify, question or include in their assessment report.

MW and MWh are often misunderstood

Capacity is often used where it should be Capacity Factor that applies. Also capacity can be stated as direct current (DC) or alternating current (AC). A solar works with a stated capacity of 110MWdc is only an 87MWac capacity plant. The reduction from 110MWdc to 87MWac is the energy conversion loss from the direct current produced by the solar panels and the conversion to alternating current, which is then exported to the NEM grid. In this real-life example the loss is about 21%.

If capacity is expressed without the 'dc' or 'ac' designation it should be assumed as 'ac', as this is the output/input of the NEM grid. This lack of clarity impacts understanding, comparison, design and planning evaluation.

Lack of clarity around capacity and capacity factor (see definition and examples in Appendix B) also impacts understanding, comparison, design and planning evaluation. Capacity, measured in megawatts (MW), is the maximum energy level that can be generated at a point in time, whereas Capacity Factor (CF) is measured in megawatt hours (MWh) and is the actual amount of electricity generated over a period of time, such as a full year. The economic life of an electricity generation works is another important relevant factor. Economic life is shorter than physical life. Other factors are declining generating efficiency

over time and necessary frequent replacement of major components, such solar panels, invertors and batteries.

Just as greenhouse emissions are converted to carbon dioxide equivalents (CO₂e) for ease of comparison, we need a capacity equivalence (Ce) measure to enable meaningful comparisons between various electricity generation technologies. We develop a 'Ce' for Glenellen solar later using their data and other data.

The DPE Assessment Report

Deficiencies of the DPE Assessment report

SOS has several reservations with the DPE's recommendations and conditions and the apparent lack of understanding to key claims of the Proponent for the Glenellen Solar Works.

These include:

1. No consideration of the disparities between projects. They all only produce one product! - alternating current electricity, yet have large differences in physical and economic lives, CO₂ and greenhouse gases savings, capacity factors, and water use. The DPE seems to accept the multitude of assertions, omissions, errors, marketing hype, misleading statements and likely ineffectiveness of questionable mitigation proposals made by the Proponent and their tightly managed 'consultation' process. Refer to Appendix A
2. End-of-life condition is toothless. Assurances by a developer who in all likelihood will sell the project once it is "shovel-ready" has no skin in the end-of-life requirements. It will take as long to decommission and rehabilitate the land as it did to construct the solar works then the future cost involved will be enormous. What if the works owner or host landowner cannot fund the work? It is even unclear who is responsible for the end-of-life actions, the solar works owner, the land owner, the local council (EPA puts responsible on them for any toxic cleanup). An end-of-life cost estimate must be provided and an upfront indexed bond must be provided to ensure inter-generational equity.
3. The proposed fire mitigation still leaves INCREASED risks. Fire-fighters will not enter a solar works fire. Chemically laden toxic smoke is not mitigated. Refer Appendix D for details.
4. No recognition of the potential toxicity of solar panels leaching into soils and water supplies both insitu and on disposal e.g. requiring soil and water testing before and after installation and after a damage incident. PV solar panels are declared as e-waste in Victoria, the EU and elsewhere because of their toxic chemicals that can leach from solar panels insitu or in landfill. Refer Appendix D for details.

5. No apparent understanding of capacity factors, panel degradation, panel damage susceptibility and the effects on output over time.
6. No mention of the government guaranteed \$40 per megawatt hour subsidy the Project will receive, a total of \$17.66 million a year. The Council is to receive \$2.5m over decades, which is paltry by comparison. On the secondary market for the Large-scale generation certificates (LGC) would currently fetch \$60 each, a yield of \$26.5m. The Large-scale Generation Certificates (LGCs) subsidy is funded from taxes and government debt, which we now, and our children and grandchildren will in future, pay for through higher taxes and higher prices for goods and services.
7. No mention that the Proponent has not received a social licence for the project. The fact that the weight of objections (79 compared to 27 in support) means the project has not earned a social licence from the communities. We understand that this is a requirement.
8. Retiring biodiversity certificates still reduces the flora and fauna at a local level, whether endangered or not. The cumulative impacts of a reducing more and more wildlife habitat will impact the local ecosystems.
9. No capacity equivalence comparisons mislead the public. The 200MW solar project generates electricity that is only equivalent to a 25MW base-load electricity generator over its single life-time. Thus, this eight-fold difference has severe implications for the amount of resources actually consumed and waste created over the next few decades. Refer to Appendix B for explanations of capacity and capacity factor and also the SOS research paper.
10. No recognition of the resources taken away from the local communities, such as quarrying materials, cement, medical services, ease of travel, etc.
11. The \$250m investment only includes a small unspecified Australian content. Most of the components are imported. This content should be specified to reflect the true investment benefit to the local economy and Australia's economy generally.
12. Does not take into account the enormous amount of resources required for the project and the ongoing sustainability of such resource requirements, especially when the project would unreliably and intermittently produce so little electricity over its life-time. Refer Appendix D for examples.
13. An industrial solar works is not a primary industry venture. The DPE used to refer to proposals such as Glenellen Solar as "electricity generating works". Referring to solar and wind electricity generating works projects as "farms" is insulting to our farmers. A farm is defined as "an area of land consisting of fields and buildings, where crops are grown or animals are raised." [Collins dictionary]. The DPE should use the correct technical description of "electricity generating works or "works" for short.

In particular, we believe that the DPE has failed to consider a number of relevant factors its recommendation and suggested conditions. These factors include:

1. Failure to assess the significant **embedded greenhouse emissions** even to just the commissioning stage let alone the full life-cycles, which results in significant upfront creation of greenhouse gases and future "lumpy" increases in CO₂e. Such upfront GHG emissions may never be offset as claimed.
2. Failure to recognise that the project must **increase the cost of electricity** to NEM consumers, which has adverse consequences for both the NSW and Australian economy. It certainly is not in the public interest to have near the highest electricity prices in the world with even more increases likely.
3. Failure to **consider both benefits and costs** to arrive at recommendation that is in the "*...public interest and approvable*".

Each of the above points are discussed below.

Embedded Greenhouse Gas Emissions (CO₂e)

The Proponent avoids stating the capacity factor (we calculate as 25.2%) for its solar project and is vague on its expected life (20 - 30 years) because of the negative implications that flow from them. The increase in greenhouse gas emissions and increase in retail electricity prices being but two of them.

The implicit capacity factor for this 200MWac capacity Solar Works is 25.2% [441,504MWhpa divided by maximum potential annual output of 1,752,000MWh = 25.2%] and a claimed life of 20 - 30 years (physical or economic?), which means that:

1. Where the PV solar panels and components are imported from matters but has been not explicitly stated. Just one type of PV solar panel, excluding the aluminium frame, made in France is claimed to offset its embedded CO₂ in 1.5 to 2.5 years. The same panel manufactured in China takes 10.5 to 17.5 years of electricity output to offset the energy to make it.

Add to the PV solar panels the embedded CO₂e in the aluminium frame, the steel pilings/cross-members and the rest of the components and materials for the project, which all require mining, processing, manufacturing, sea transport, and land transport. Then add the embedded CO₂e from the large-scale initial and permanent removal of CO₂ absorbing vegetation and all the construction activities. Further, add the embedded CO₂e in the associated infrastructure and firming requirements.

Therefore, it is evident that very substantial greenhouse emissions are embedded in the Glennellen solar works by the time of commissioning. But how much embedded CO₂e? SOS has attempted to answer this question using the available information.

The DPE has neither asked this question or the Proponent provided any transparent

information. But it is very relevant to meeting mandated emission reductions.

2. This 25 year life project claims it will save 423,800 tonnes of CO₂ annually, which equals 0.96 tonnes of CO₂/MWh of the initial annual output [423,800t/441,800MWh]. Assuming it takes 10 years or more, as some studies have suggested, to fully offset its embedded CO₂e content then the original embedded CO₂e content is at least **four million tonnes**.

The 37 year old Bayswater Power Plant creates 1.3t/MWh of CO₂ emissions but a modern 50 years life High Efficiency Low Emissions (HELE) coal-fired power plant with carbon capture and storage creates 90% less emissions [[New Generation Coal Technology - Why HELE coal-fired power generation is part of Australia's energy solution - Whitehaven Coal](#)] than Bayswater at just 0.13t/MWh (1.3 x 0.1). Over 10 years such a HELE power plant that produced the same output as Glenellen Solar [423,800MWhpa x 10] would only create a total of **0.55 million tonnes** [4,238,000MWh x 0.13t/MWh] of CO₂ in comparison with Glenellen Solar's upfront **four million tonnes**. This difference in timing and amount of CO₂ created is so significant it must not be ignored by the DPE and IPCN.

Assuming each of the 393,960 PV solar panels has an aluminium frame weighing 2kgs with an embedded CO₂e of 8.1kg/kg of Aluminium, then the total **embedded CO₂e of just the frames is 6,383 tonnes** [393,960 panels x 2kg Al x 8.1kg CO₂e then converted to tonnes].

For one kilogram of steel the embedded CO₂e is 2.75kg. If Glenellen solar used 26,700 tonnes of steel for the pilings and cross-members then the **embedded CO₂ in this steel would be 73,425 tonnes** [26,700t x 1000 x 2.75 then converted to tonnes].

For B-Double and Semi-trailer trips between the Port and the Solar site was 700km return then each trip would burn nearly 330 litres of diesel and oil. About **0.871 tonnes of CO₂e** would be created per return trip. 1000 trips creates 871t of CO₂.

With this project's capacity factor of 25.2% that declines at about 0.5% a year, at least four of these 200MWac solar projects would initially need to be built just to match the output of a 200MW 24/7 base-load power plant (HELE, CCGT, nuclear). Another four or more solar works would be required again in 20 - 25 years, while the base-load power plants are only half-way through their life span. Thus, an eight-fold increase in upfront embedded CO₂e emissions could be expected.

Just the above few estimated CO₂e calculations indicate the potentially very high creation of largely pre-commissioning CO₂e for the project. The lack of comprehensive data, especially for Australia, makes getting a true picture of how solar works claims of being a clean energy source are actually unjustified.

3. In addition to the directly embedded greenhouse gases in the proposed project there are all the emissions that can be directly attributed to the life-cycle of the

project because of the necessary indirect infrastructure associated with it, such as upgrades to external roads, upgrades or provision external electricity infrastructure, and the building and operation of disposal facilities, as well maintenance activities of washing panels, slashing large areas of grass, replacing components, end-of -life disposal and recycling, land rehabilitation, etc.

Assuming the aluminium frames and steel pilings/cross-members were recycled at the 20 to 25 years end-of-life the CO₂e released would be 54,976 tonnes [(787,920kg Al + 26,700,000kg steel) x 2kg CO₂e/kg of metal]. Additional CO₂e will be created at the 20 - 25 years end-of-life from decommissioning, removal, site rehabilitation, recycling, waste disposal and the prior construction of a replacement works built elsewhere. A BESS works, if added to the project, would add more CO₂e more frequently as batteries and inverters have shorter lives than the solar works.

4. According to the Intergovernmental Panel on Climate Change, the majority of CO₂ produced today will not dissipate in the atmosphere for well over 100 years. Yet this project before commissioning will have generated immediate and very significant increases in greenhouse emissions that may never be offset because of the project's low energy output, relatively short economic life, ongoing frequent maintenance requirements [e.g. mowing, panel & equipment replacement, use of water trucks], alternative backup/firming requirements, and significant end-of-life decommissioning, disposal and land rehabilitation requirements and the ongoing reduction in fossil fuel power generation.

In addition, with less and less fossil fuel generation available to be offset as coal-fired power stations close down then the conclusion is that each new solar or wind project has to increase global CO₂e emissions.

5. Unlike the current coal-fired power plants operating in Australia, which release their greenhouse emissions progressively over their long lives and high electricity output, the solar works creates massive upfront greenhouse emissions that may take years, if ever, to offset. Modern High Efficiency Low Emissions (HELE) coal-fired power plants and high utilisation Combined Cycle Gas Turbine (CCGT) plants are being built now in many countries around the world, as are near zero emissions nuclear power plants. This solar project could not compete against a HELE plant that produces 90% less emissions, let alone a zero emissions nuclear plant, because the Glenellen solar plant starts with a very large CO₂e deficit.
6. Based on just the foregoing, we have established that this project is unlikely to significantly reduce greenhouse emissions, in particular carbon dioxide emissions, over its claimed and unproven 25 - 30 years life.

The proposed solar project therefore fails the first fundamental requirement that it must significantly reduce greenhouse emissions over its lifetime. As it claims annual CO₂ savings of 423,800t of CO₂e emissions it must also have to bring to account what it initially and subsequently creates. This is a serious omission by the DPE when evaluating the benefits of the project. Mitigation can be achieved by modern

available alternative and emerging technologies.

Therefore, the claimed benefits of the Glenellen Solar Works can be significantly improved upon by alternative means to achieve greenhouse emissions reductions.

7. In concluding this section, just as the IPCN refused the Bylong Coal Project in 2019 because it was contrary to the principles of ecologically sustainable development, including climate, the Commission should refuse the Glenellen Solar project for similar reasons.

Lowering cost of electricity to end consumers

The second fundamental requirement under the net zero policies and legislation of our governments is for a solar works project to lower electricity prices to the end consumers.

1. The simple fact is, as first identified by SOS in 2019, that no country or jurisdiction (e.g. Germany, UK, California and now Australia) have reduced electricity prices once their total installed capacity of solar and wind electricity generation exceeds 30% of the total system capacity. As at June 2023 the installed industrial capacity of (grid) solar was 13.6% and wind 16.2%, a total of 29.8%.
2. For those jurisdictions with 30% or more of wind and solar capacity they have amongst the highest retail prices in the world. Nuclear powered France has about half the retail electricity costs and half the CO₂e emissions of Germany. China is still heavily reliant on fossil fuels and has the highest emissions but retail electricity costs were about one third of that of Australia.
3. Finland has recently commissioned a nuclear plant (Oikluoto 3) with an immediate 75% reduction in electricity costs. Sweden, France, UK and Canada have all recently announced they are increasing their nuclear fleet of power plants. Germany has restarted its coal fired-power plants as the high cost of electricity drives its manufacturers to relocate production overseas, including to China. They all have recognised that wind and solar electricity generation is too unreliable and too expensive.

SOS was highlighting back in 2019 that this was likely to occur. Subsequent revisions to our first research paper included changes in tense from future to present tense. Also, Australian examples, such as wind turbine, solar works and BESS fires, turbine blade dumping, weather damage, output not being achieved, cost blow-outs and grid instability all supported our initial work. Our attachment "Wind and Solar Electricity Generation Are the Answer. Seriously? November 2022" covers these aspects and many others in more detail.

4. Nearly all investment has been in solar (rooftop and industrial) and wind generation capacity and battery storage in the NEM grid over the last seven years. Over that time the electricity index followed an upward trajectory well above inflation and will be 64% higher for year 2023 compared with 2016 (see Appendix C). The Proponent's

unsubstantiated claim that their solar project will put downward pressure on electricity prices is inconsistent with both Australia's and overseas actual experiences to date.

5. One resident in the Central West Orana Renewable Energy Zone, where there are already several operating solar works, had their electricity costs increase substantially over the last four years. Despite changing plans six times to the best available offer, on a like-for-like annual consumption pattern, their gross electricity costs have increased by 83% and their net bill, after solar feed-in tariffs, has increased by 538%. Obviously, regional REZ customers are increasingly carrying the higher costs of renewables construction in the region.
6. The claim that the project will generate enough electricity to supply 76,500 NSW households is invalid and intentionally misleading, unless each householder is willing to have no electricity for most of the time. [133.7kWh per week per parliament NSW website = $52 \times 133.7\text{kWh}/\text{week} = 6952.4\text{kWh} = 6.952\text{MWhpa}$].
7. The Glenellen Solar project has an initial capacity factor of 25.2%. The other 75% to almost 100% of the time or 18 to nearly 24 hours a day electricity consumers will have to get electricity provided from other generating sources, but at what cost?. The legislated wind and solar capacity target of 82% by 2030 means that all the renewables works built from 2020 to 2030 will need to start being replaced from before 2040, which in most cases will require new locations as costly decommissioning, disposal and land rehabilitation takes two or more years.
8. The DPE references the financial payments to be made to community groups and Council but ignores that these payments are just a fraction of the \$17.6 million to \$26 million the project will receive annually from the Large-scale Generation Certificates (LGCs), which we all pay for through higher taxes and higher prices for goods and services. These subsidies over decades not only return the capital cost to the Proponent but also funds the payments into "community benefit funds" and compensation to landowners. This on-going burden will be carried through to future generations, which is contrary to the principle of "intergenerational equity".
9. The Proponent for this Solar Works project has not proven that their assertion that their proposed project will lower electricity prices to end consumers. History to date supports that the NEM electricity prices will continue to remain amongst the most expensive, if not become the most expensive, in the world as more and more solar, wind works, BESS works and pumped hydro works are built. Then comes the replacements once the first solar and wind projects come to the end of their relatively short life of 20 - 30 years. Such replacements will need to be started years before decommissioning of an existing wind or solar works.
10. The Glenellen Solar works will not result in lowering consumers electricity prices and therefore fails the second fundamental requirement that it must significantly reduce electricity costs to consumers over its lifetime. It also cannot be in the 'public interest' to have unaffordable and unreliable electricity, which is already leading to

Australian citizens dying, businesses closing and alternative household and business electricity generation options having to be pursued. Households, for example, in the CWO REZ have been subjected to blackouts and brownouts for years. It will only get worse according to the recent AEMO warnings.

Secondary objectives

Secondary objectives of the net zero policies are that the project produces clean, reliable, and secure power and provide good jobs in regional NSW. We believe the project fails achieve any of these secondary objectives, as outlined below (refer to the SOS research paper for more detail).

Clean

The project is not 'clean' because its up to 200MW capacity is only equivalent to about a 25MW modern HELE or Gas fired plant or small modular reactor, each with lives 50 years or more. [200MW X 25.2% CF X.05 life span = 25.2MW Ce]

This means that to achieve capacity equivalence (Ce) over 50 years the solar project would need to be eight times larger and require considerably more resources of all types, so creating even more embedded and ongoing greenhouse emissions.

The emissions could not be offset as there would be no fossil fuel power stations to offset against under the current plans of near 100% wind and solar generation by 2050. In this case the CO2e payback duration would be infinite.

Reliable

The solar output is only as reliable as the weather and the seasons. It is also weather vulnerable. Solar works in Australia have already had severely reduced output due to heavy rain, lightning strikes, strong winds, hail, very hot days and grass fires.

Secure

Electricity system security and national security cannot be assured when almost the whole NEM electricity system is dependent on a single source of supply.

Regional jobs

Experience and current plans shows that few construction jobs can be or are filled by locals. Operational jobs are very few indeed. Proposals for huge multiple construction labour camps to filled by 2100 -2600 outsiders are already in the pipeline, with just three of many already greater than the nearby town's total population of 2700 people. Will the outsiders be Australian workers or, has been the case for Beryl, Wellington and other solar works, backpackers and visitors on temporary work visas?

Result: The claims of being clean, reliable, secure and a substantial local regional job creator are unsubstantiated and misleading. The primary and secondary objectives will not be met by the Glenellen project.

Conclusion

Save our Surroundings (SOS) only highlighted a few issues in this submission. We hope the Commission will critically assess the significant deficiencies we have raised with the Glenellen Solar proposal and DPE Assessment Report. The upfront and repeated creation of substantial greenhouse gases, the driving up of NEM system electricity costs because of a very low capacity factor, declining efficiency and short lives and are but two matters raised. Our attachment expands on these and many other issues.

Also, the project will not meet the secondary objectives of being clean, reliable, secure and a substantial local regional job creator.

We disagree with the DPE's conclusion that the project is in the "*...public interest and approvable*". Based on the analysis and evidence provided in this submission we trust that the Commission will reach the same conclusion as has SOS.

Your sincerely
Save Our Surroundings

Appendix A: Some Uncovered "errors" in Solar, BESS and wind proposals

Save Our Surroundings examples:

1. Two solar works proposals claimed their PV solar panels were non-toxic, the fire risk could be mitigated and that they were a primary industry, which SOS argued to the Regional Independent Planning Panel they were false claims. The two DAs were rejected 4 nil and 5-0.
2. A solar works proposal claimed a life for its project of 50 years. At the Regional Independent Planning Panel hearing SOS questioned their claim. The Chair supported our question and the Proponent had to admit the likely life would be 25 years but may be "repurposed" for another 25 years. The DA was approved never-the-less. Again, a fundamental misleading claim got all the way to the panel hearing. Where are the experts to verify the claims of Proponents that are in fact incorrect, false, misleading, etc.?
3. A large solar works with BESS was approved despite many dozens of errors, inconsistencies, omissions, unsubstantiated claims, etc. raised by SOS. The project recently started construction and already accommodation cannot be found, local roads, which the Proponent said would not be used, have required resurfacing because of damage from non-local water tankers in only the first few months of construction.
4. A stand alone BESS claimed an output that SOS calculated from their raw and "hidden" data meant the batteries and inverters would have to be replaced around every five years. The Proponent in its Response to Submissions (SOS being the only one to object) found a "calculation" error and reduced its forecast output from the BESS from 380,000MWhpa to just 146,000MWhpa. Without the tedious time-consuming work of SOS this "error" of a most fundamental nature would have gone unnoticed. The Project was approved never-the-less. Our concern is we discover many such "errors" in every DA or EIS. What is the purpose of the DPE if they keep missing such "errors" etc. or they seem not concerned by them?

A Recent Council objecting submission example

Extracts from a Council's submission objecting to a Large Solar Works with BESS contained dozens of incorrect statements in support of the proposal. So many errors are the result of sloppy analysis or deliberate misrepresentation so as to 'sell' the project to the authorities, with little regard for genuine concerns of the affected communities. The project is yet to be considered by the IPCN. The Council wrote:

" Council objects to the proposal as the provided documentation is both inaccurate and inconsistent, further it fails to appropriately consider the cumulative impacts of surrounding renewable energy projects within the region." and,

"A significant proportion of the data used continuously draws upon outdated sources. ...",

" Ultimately, the use of such data has led to the creation of many misleading assessments, skewing predicted accommodation requirements and local employment ratios along with many other predicted impacts." and,

"To further speak to the inaccuracies throughout the documentation, the provided EIS has identified multiple sources of infrastructure that simply do not exist."

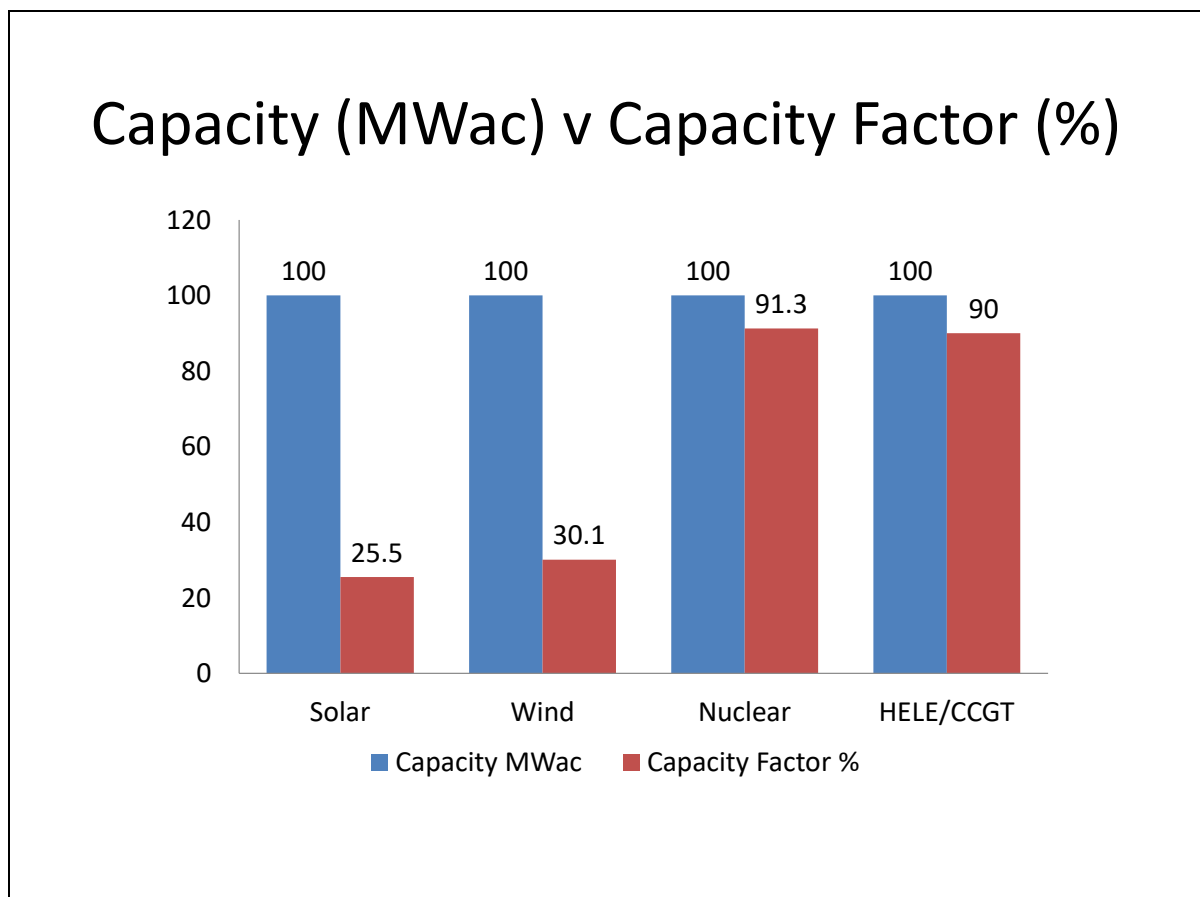
Appendix B: Capacity factor

Capacity factor (CF): The net capacity factor is the ratio of an actual electrical energy output over a given period of time to the maximum possible electrical energy output over that period e.g. a 1MW wind turbine may produce 2,637MWh in a year out of a possible 8,760 MWh, therefore its capacity factor is $2,637/8760 = 30.1\%$, which is a typical value for modern wind turbines. For solar panels the typical capacity factor is less than 26%. For new coal and nuclear power stations the typical capacity factor is 90% or more, which is why they are the backbone of most of the electricity systems throughout the world.

Modern CCGT plants are so efficient that the entire USA fleet of natural gas combined-cycle power plants has increased the average utilisation (capacity factor) from 40% in 2008 to 57% in 2022.

[[U.S. Energy Information Administration - EIA - Independent Statistics and Analysis](#) Natural gas combined-cycle power plants increased utilization with improved technology]

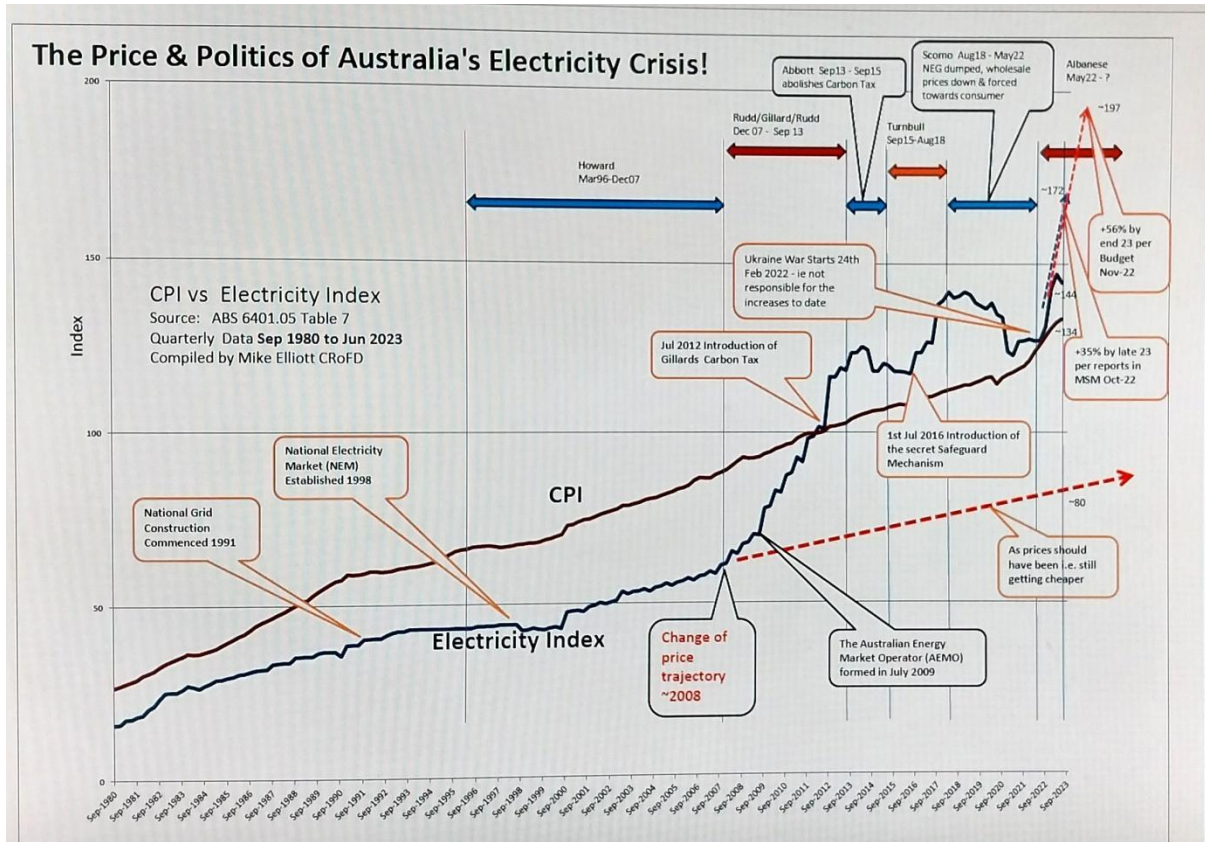
SOS created this graphic to illustrate the CF of different technologies.



Estimated or actual annual output in MWh = Capacity factor % x (capacity MWac x 24hrs x 365 days)

[What is Generation Capacity? | Department of Energy](#)

Appendix C: The Price & Politics of Australia's Electricity Crisis!



Appendix D: Common Issues with Solar Works Proposals

This appendix summarises responses by a Solar Works Proponent to four typical questions that apply to such projects. SOS believes the conditions imposed and policing of undertakings are often inadequate. SOS provides comments and recommends conditions based on real-world experience.

The four issues considered in this appendix are:

1. Do PV Solar panels leach dangerous chemicals when insitu and on disposal?
2. How would the proponent manage the disposal of any damaged solar panels?
3. Noting the potential for grass fires in the area, what measures would be in place to manage this risk?
4. What vegetation screenings and ongoing maintenance do you propose for your project?

1. Do PV Solar panels leach dangerous chemicals when insitu and on disposal?

If the responses of the Proponents are to be believed then all e-waste legislation across the globe must be wrong and therefore should be repealed. That would include e-waste classifications for mobile phones, computers, televisions, etc. as well as all the different types of PV solar panels, as they all contain similar toxic chemicals.

The European Union and numerous other jurisdictions have declared PV solar panels as e-waste because they are considered dangerous. Statements like these from the Victorian EPA, apparently based on convincing scientific evidence, are invalid according to the Proponent.

"It is estimated that more than 100,000 tonnes of solar panels will enter Australia's waste stream by 2035. This has the potential to create a hazardous waste management issue, as materials contained within solar panels can leach into soil and groundwater, causing environmental contamination and safety concerns if managed poorly. Keeping these materials out of landfill prevents environmental and human health problems, and rescues valuable resources for reuse. Compounding the issue is a lack of dedicated processing facilities in Australia that can recover valuable materials contained in PV products." [ref: www.sustainability.vic.gov.au "The growing issue of PV system waste"]

However, the Proponent have admitted that PV solar panels also leach chemicals while in situ, based on their own statements, as follows:

"A US study conducted in 2017 on a solar farm constructed in 2012 concluded that there were some increased level of selenium, strontium, lithium, nickel, and barium levels in soils closer to PV panels, but stated no increases in lead or cadmium."

"Studies from the International Energy Agency and the UN have noted that risk to human health and water contamination from heavy metals leaching out of solar panels is below the USA's screening levels and within World Health Organization guidelines (ABC, 2022)."

This study concluded that the leaching of lead from PV solar panels is above safe-limits. <https://www.sciencedirect.com/science/article/abs/pii/S0048969721017137> (copy & paste).

There are many types of PV solar panels. Each may have different chemical mix in them. [\[Comprehensive Guide to Solar Panel Types | Aurora Solar\]](#) Panels, after decommissioning, that contained zinc were found to have contaminated the peanut growing farm. What was a "harmless" chemical turned out to have detrimental impacts on at least one type of farming. Details of the different types of solar panels can be found in the following link. 'Materials for Photovoltaics'. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6412461/> (copy and paste into browser). This study of polycrystalline PV solar panels found leached lead in particular was above safe limits. [Evaluation of heavy metal leaching under simulated disposal conditions and formulation of strategies for handling solar panel waste - ScienceDirect](#)

The site is 1021ha and the development footprint of the 215MW Oxley Solar Works is stated as 268 hectares, which will accommodate 385,280 solar panels or an equivalent to 32,576 rooftop systems of 6.6kw each (215,000kw/6.6kw). Thus, the concentration of hundreds of thousands of PV solar panels over 2.68 km² of agricultural land for up to 25 years poses short-term and long-term contamination risks of yet unknown proportions. The area involved of even of the relatively small Oxley Solar Works magnifies the risks of large-scale damage and site contamination.

Nearby residents have a right to be concerned about the potential for toxic contamination from PV solar panels and industrial batteries. People thought, for example, that asbestos, DDT, fluorocarbons, and smoking were good ideas at one time. The precautionary principle, intergenerational equity, social impacts, environmental harm, sustainability and public interest principles should apply.

Taking the Beryl Works as an example, a grass fire at the works reportedly damaged 18 hectares of PV solar panels in April 2023. Despite requests to the DPE as to what happened with the damaged Cadmium-Telluride (thin-film) panels and if soil and water testing was done we are still to find out.

Examples of wind, hail and fire damage are:



Despite SOS's requests to the DPE that soil and water testing for chemicals contained in PV solar panels be done before installation (base-line) and routinely (annually) and after an incident (damage e.g. hail or fire) no such conditions have apparently been applied to any proposal to date.

Recommendations: We request that the IPCN place the following conditions on the project (not the developer who is unlikely to be an owner in the future):

1. That independent statistically significant soil testing be done across the whole of the development footprint for all the chemicals contained within the chosen and to be installed PV solar panels. The results will form the base-line against which future testing will be evaluated.
2. That once commissioned, independent statistically significant soil testing be done annually across the whole of the development footprint for all the chemicals contained within the installed PV solar panels.
3. Following a significant incident of panel damage involving (say) 5% or more of the PV solar panels then an independent statistically significant soil testing be done of the whole of that area.
4. That the soil testing only be carried out by a Department of Planning and Environment NSW or EPA approved soil-testing and analytic expert.
5. That the initial and all subsequent soil-testing results be lodged within two months of testing and the results made available to the local Council(s), the DPE and general public via the project owner's website.

2. How would the proponent manage the disposal of any damaged solar panels?

The Proponent of a Solar Works stated:

"There are currently at least 11 companies who recycle solar panels and products in Australia; Reclaim, PV (interstate), PV Industries (NSW), Solar Professional (NSW), SolaCycle (NSW), CMA Ecocycle(NSW), Ecoactiv (NSW), Elecsome (interstate), Solar Recovery Corporation (interstate), ScipherTechnologies (interstate), Lotus Energy (interstate), WA Recycling (interstate). Panel repurposing (such as using sub optimum output panels for other projects) and panel recycling industries are expected to grow as more solar projects are approved. The fast-paced rate of technological change with regard to PV and battery technology is likely to trend toward longer lived infrastructure with increased recyclable content. The Clean Energy Council of Australia has noted the following national solar PV recycling research projects/funding taking place:

1. The NSW Government has committed \$10 million to boost solar panel recycling.
2. Researchers at Deakin University working to develop a solar panel recycling solution to recycle silicon.
3. \$15.14 million awarded through the Australian Renewable Energy Agency (ARENA) to support research teams at six Australian universities including investigating new solutions, including upfront solar PV panel designs and end of life processing, that increase the cost effectiveness of sustainable end-of-life management of solar PV panels. As the solar industry becomes established in NSW, further opportunities are considered likely to be identified regarding local and regional reuse and recycle options."

SOS Comments:

The preceding statements by the Proponent raise a few further related issues concerning the disposal of end-of-life PV solar panels.

The first commercial PV solar panels were invented in the 1950s by Bell Laboratories. Western Europe and the USA for instance, have been decommissioning solar works for several years (USA average life 21 years as at 2021). Yet economic recycling of solar panels still eludes them. If economic recycling of panels existed overseas then successful companies would set up recycling plants in Australia, especially as government assistance is so generous.

Why are Australian governments funding start-ups and research into recycling for such a long-lived issue? This long-running issue is a global problem but has been imported into Australia.

"Panel repurposing (such as using sub optimum output panels for other projects) and panel recycling industries are expected to grow as more solar projects are approved." We agree that more and more waste will be left for current and future generations to deal with on a massive scale and cost. "Panel repurposing" actually includes exporting the damaged or uneconomic solar panels to third world countries for minor home use or just as likely to extract what the poor people can before dumping the useless panels in their landfill.

"The fast-paced rate of technological change with regard to PV and battery technology is likely to trend toward longer lived infrastructure with increased recyclable content." It has taken nearly 70 years to go from an 8% efficiency to a commercial low 20s% today. Hardly fast paced change. One change has been in the silver content of panels. A decade or so ago the silver content was very high so extracting it from solar panels was the main recycling effort.

However, modern panels have very much less silver in them, so making extraction less economic. According to energysage.com undamaged second-hand PV solar panels are worth between US\$0.10

to \$0.75 per watt. [Ref: www.energysage.com Used solar panels: Are They a Good Idea?]. Therefore, a used 560W Oxley Solar Panel today would be worth about US\$55.80 to US\$418.50. A damaged one probably zero. A US study found that recycling a solar panel cost US\$10 per watt but only yielded US\$2 in recovery value. Hence panels are not even close to being economically recyclable.

The claim that "There are currently at least 11 companies who recycle solar panels and products in Australia" is misleading. A typical tactic of developers. Reclaim PV Recycling Pty Ltd was the first and most quoted large-scale recycling plant in Australia, which was established in mid 2019 after years of research and logistical modelling. It became insolvent in 2022 and as at September 2023 was being wound up. Its facility had stock-piled 50,000 to 100,000 panels, including cadmium telluride panels, which can only be processed in one or two facilities overseas.

All the others named "recyclers" either only remove the aluminium metal frames and the regulators or recycle other materials not related to solar panels. The balance of the panels are stockpiled or possibly sent to landfill. None are actually have started processing solar panels.

[ref: [pv magazine issue 06/23 https://www.pv-magazine-australia.com/2023/06/17/weekend-read-solar-recyclings-glass-ceiling-and-other-problems/](https://www.pv-magazine-australia.com/2023/06/17/weekend-read-solar-recyclings-glass-ceiling-and-other-problems/)]

The Solar Works will have around 8,476,160kg (8,476 tonnes) of solar panels to dispose of at decommissioning plus many tonnes of panel replacements during the operational life-time. But no solution yet exists for environmentally friendly way of disposing of them. Are we, our children and our grandchildren and even beyond have to deal with this burden. Will they ask why did our generation know of this long-standing problem yet just pass it onto us? Should not the precautionary, intergenerational equity, social impacts, environmental harm and public interest principles be applied?

This project contributes to the solar panel waste problem as well as the lithium battery waste problem and therefore must be held responsible for the further imposition it will place on our society and environment should the project proceed. After years of talk and research there are no adequate solutions from the industry for these rapidly growing waste issues . [[National approach to manage solar panel, inverter and battery life cycles | Sustainability Victoria](#)]

The Proponent should not have mislead the authorities and the IPCN on this issue.

Recommendations: We request that the IPCN place the following conditions on the project (not the developer who is unlikely to be an owner in the future):

1. That a contribution of (say) 2% of the capital value of the project to fund the research into the safe and economic recycling of solar panels, batteries and inverters.
2. That an onsite covered and enclosed storage facility be established that will safely store damaged and end-of-life PV solar panels, inverters and BESS batteries until they can be fully recycled and disposed of economically and safely.
3. That a contribution of (say)\$5 per solar panel be paid into a fund for the establishment of safe off-site storage facilities.
4. That no solar panels, inverters or batteries or parts thereof be disposed of in landfill either within NSW or elsewhere.

3. Noting the potential for grass fires in the area, what measures would be in place to manage this risk?

SOS Comments:

The Proponent has stated the usual response to the management of fire risks. The proposed measures, such as a 20,000 litre water tank, 10 metre APZ, vegetation management, and bush fire management plans, will not eliminate the INCREASED risks involved.

Country regional inhabitants fear grass and bush fires above all other dangers they face. They are frequent, occur any time of year and can quickly become devastating. The proposed standard response to fire mitigation fails to address any of the following:

- the Solar Works will INCREASE the risk of fires starting on the site and spreading from within or from outside the site. The INCREASED risk remains with the proposed mitigation proposals.
- Mitigation of chemically laden toxic smoke released from burning solar panels, lithium batteries, inverters, electrical wiring and other components has not been addressed at all.
- Rural Fire Service personnel are volunteers who have jobs or run farms and businesses. Volunteer numbers have been falling just when the wind, solar, transmission lines and BESS projects are increasing across rural and bushland areas.
- Many RFS fire-fighters have died whilst fighting grass and bush fires, including at least two in 2023 so far. It is a very high risk service they provide, not only to their own communities but across all regional communities and even overseas. The risk to them is INCREASED when they have to contain a fire occurring within a solar works or BESS. Toxic smoke INCREASES the risk over and well above the ash from a vegetation fire.
- The RFS, FRNSW and HAZMAT services will not enter a burning industrial solar works site or BESS due to electrocution risks, entrapment risks, explosion risks and chemically laden smoke risks. They will try to contain the perimeter but the sheer size of the fully high-fenced site makes this much more difficult. In this case size matters!
- It takes considerable time for each RFS team to assemble when a fire emergency occurs as many of them will be located well away from their base. The distances to be travelled from towns, farms, businesses are measured in tens of kilometres. An out of control grass fire can spread very quickly under benign conditions let alone under adverse conditions at any time of the year.
- If a BESS catches fire then RFS and FRNSW services have to tie up crews for days to contain the perimeter while the chemical reaction battery fire burns itself out. For the two BESS fires in Australia so far this took four days each. This EXTRA utilisation of fire-fighting resources puts other parts of the region at additional risk, especially when volunteer numbers are falling and funding is scarce.
- Special fire-fighting protection gear, such as additional breathing gear, is required to be near burning batteries and solar panels. Extra cost to the RFS and also space on fire trucks is already limited, so not all RFS volunteers will have access to such additional protective gear.
- RFS personnel are prohibited from publically speaking about how they respond to industrial solar, wind and BESS fires. The FSNSW was threatened to be sued by the

owner/management of a recent solar works fire if they did not remove the photos from social media that they took of the fire. One of the FSNSW crew at the fire was also ordered to take down his personal photos of the fire, even though they were shot from outside of the burning site.

- While a different Council, the MWRC requires a land owner of 5 or more hectares to install a 20,000L water tank fitted with a 65mm storz fitting or reserve 20,000L of a larger tank for fire-fighting purposes. By the end of 2019, after three years of drought, virtually all water tanks and dams were dry. In late 2023 75% of NSW is already drought affected and regional people are once again trucking in water to their properties for domestic use and for their livestock. "The Development footprint will house a 20,000-litre water supply (tank) fitted with a 65mm storz fitting shall be located adjoining the internal property access road within the required APZ." is clearly inadequate. Hundreds of thousands of litres of water were used on just the two BESS battery fires. Not to extinguish but to keep the other units cool.
- Three out of control grass/bush fires near Gulgong in just October 2023 reached Emergency Level. They took days to control. Strong daytime winds blew burning embers hundreds of metres ahead of the fire front, causing additional fires. Likewise, a fire that started last year in a field across the road from a solar works and in benign conditions jumped the road and was extinguished just as it reached the solar works boundary. This was despite 15 emergency vehicles being present at the time and three water-bombing helicopters being used. This is the reality of our regional fires. "An APZ of minimum 10m would be maintained between all vegetation and solar farm infrastructure within the Development footprint." is meaningless when faced with the reality of an out of control grass fire.

Some examples of recent grass fires in a designated Renewable Energy Zone:

The Leadville-Dunedoo fire (Sir Ivan bushfire) of February 2017

[NSW coroner to inquire into 2017 Upper Hunter and Central West bushfire - ABC News](#)

55,000 hectares (550km²) of land burnt, 35 homes destroyed, 6,000 livestock killed and numerous injuries, farmland and wildlife habitat destroyed, untold wildlife killed and millions of dollars in damage done. All this in about 24 hours.



February 2017 Central West NSW Leadville-Dunedoo fire front



Why we hate grass fires

Beryl fire #1 July 2022

Essential Energy reported that 144 properties in the vicinity of Beryl Solar Works had lost power. An equipment fire at or near the solar works was reported. Most of the affected properties had no grid electricity for most of Sunday and over twenty properties still had no power well into Monday. The nature and cause of the equipment fire and power outage have not been publicly reported.

Beryl Fire #2 August 2022

[Water-bombers sent to out-of-control fire near Gulgong, as wet ground hampers RFS efforts - ABC News](#)

A grass fire that started about midday across the road from Beryl Solar Works jumped across Beryl Road and into grassland adjacent to the Beryl Solar Works. A major fire emergency was declared

SOS submission to IPCN re Glenellen Solar Works

with over a dozen fire-fighting and police units dispatched within a 30 km radius or more of Beryl. In addition, three water-bombing helicopters were called in and used to save buildings and stop the fires entering the solar works, as vehicles could not get close to the fires. The fires burnt for nearly four hours before being brought under control, which was notified at 3:41pm



Fire jumped road from left to right



Fire reached solar works fence



Multiple RFS units fight the fire

Beryl fire #3 September 2022

Grass fire on the site at Beryl of yet another proposed solar works within sight of Gulgong township.



Grass fire starts about 12:20pm



Part of the aftermath

Beryl fire #4 April 2023

[Gulgong, NSW: Fire at Beryl Solar Farm | Sky News Australia](#)

On Monday 24 April 2023 at about 12:30pm a grass fire broke out. This was the worse of the recent fires that has occurred in or near the Beryl Solar Works, resulting in 18ha of damaged area under solar panels and a reported damage cost of \$7m. It burnt for about 4 hours. The several RFS, FRNSW and HAZMAT teams just protected the perimeter as they will not enter a burning solar works. A wind reversal extinguished the fire. Weather conditions were benign at the time. The cause of the fire was said to be an electrical cable fault under a solar array.



Smoke blankets nearby properties



Grass fire burns under the solar panels

Three emergency level fires between Gulgong and Mudgee in October 2023

Multiple fires around Gulgong, Ulan, Cope, Cooks Gap investigated by police, RFS amid fears they were deliberately lit.

[NSW fires around Gulgong, Ulan, Cope, Cooks Gap investigated by police, RFS amid fears they were deliberately lit - ABC News](#)

Home Rule and St Fillans properties at risk. More than 180 firefighters, over 50 fire trucks, two helicopters and a large RFS air tanker were used over several days.

[Authorities downgrade bushfire emergency warning in NSW's Central West - ABC News](#)



Some of the aftermath of the October 2023 fires along Henry Lawson Drive

The messages are clear



Grass fires kill



Firefighters are "under funded" "under resourced" "under valued"

Conclusion

The proliferation of solar and wind works, including associated BESS, inverters, sub-stations and other infrastructure, as well as new high voltage transmission lines exposes landowners and towns people to significantly increased risks over and above the level of risks they already face. Concentrating such works in such a small area so close to towns invites a disaster at some point. Not if, but when! The precautionary principle must be applied.

Existing fire risk regulations and fire risk mitigation proposals are totally inadequate for solar and wind electricity generating works and BESS works and must be substantially improved before any

more projects are approved so close to rural towns. SOS suggests for industrial solar, wind and storage projects that:

- No works be permitted within 15kms of any town
- Automatic sprinkler systems must be installed around the site perimeter
- Several onsite dams full of water must be maintained onsite for water-bombing craft use
- Several 50,000 litre water tanks must be located around the outside perimeter of the site
- Works owners must contribute financially to the local RFS and FSNSW units annually to help fund the specialised equipment and training required and for research into how to safely fight battery fires.

4. What vegetation screenings and ongoing maintenance do you propose for your project?

SOS comments:

The Beryl Solar Works, located within the CWO REZ, 5 kms from Gulgong, was commissioned in June 2019. These photos of the Beryl solar works, show how the this Solar "screening" is likely to look after 4.5 years, if it were to proceed.

The original owner of Beryl Solar committed to the Planning Assessment Commission requirement that mature vegetation screening be at least 3 metres tall by 7/8/21. This did not occur (see photos below). DPIE was advised but said they don't monitor whether the conditions imposed are met or not, it is up to the local community to complain. Beryl solar is now on its third owner in 4 years.



Photo by SOS July 2019: Beryl solar "screening" plantings



Photo by SOS November 2023: Beryl solar "screening" plantings after 4.5 years



SOS photo 1/11/2020: weed growth only



SOS photo: 17/11/2023 plants are dying

In addition, a local Gulgong resident planted 26 well established trees on their acreage property in December 2021, during a period of nearly three years of above average rainfall (February 2020 - September 2022). Thousands of litres of watering was required since planting, but especially since September 2022 because of below average rainfall to date. (75% of NSW is now declared drought affected or in drought).

Therefore, we express concern that water usage for the proposed Solar Works is inadequate. Also, the time taken for seedlings or small immature plants to grow to become sufficiently established let alone form a screen is, from our experience, much greater than three months and will take many years to form a reasonable screen.

Recommendations: We request that the IPCN place the following conditions on the project (not the developer who is unlikely to be an owner in the future):

1. That 75 litre bagged advanced plants are used for vegetative screenings that are fast growing, drought resistant and are endemic to the area.
2. A suitable water reticulation system is installed to supply water-efficient delivery of water to the screening plants.
3. The water used for the screening plants to be not taken from sources normally available to local residents and farmers.