Independent Planning Commission NSW

Independent Planning Commission - Make a Submission (nsw.gov.au)

Oxley Solar Works SSD-10346 215MW solar generator plus 50MW/50MWh BESS

Oxley Solar Farm | Planning Portal - Department of Planning and Environment (nsw.gov.au)

Submission from Save Our Surroundings

saveoursurroundings@outlook.com

Dear Commission

## Introduction

Further to our verbal submission at the 17/10/23 at Dangarsleigh Hall, 2350/874 Dangarsleigh Rd, Dangarsleigh 2350 NSW meeting we herein provide a more detailed written submission of our objections to the proposed Oxley Solar Works. As part of our submission are two uploaded attachments:

- "Wind and Solar Electricity Generation Are the Answer. Seriously"
- " BESS Deficiencies"

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 as the Oxley Solar to their environment but also the division the planning process causes in the communities.

The planning processes, as for Oxley 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 in the beautiful New England and Central West regions, 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 built.

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 Armidale 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 Oxley 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) measured in megawatt hours (MWh) is the actual amount 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 Oxley solar later using Oxley Solar Works data and other data.

## The DPE Assessment Report

### Deficiencies of the DPE Assessment report

Despite the vast majority of submissions objecting to the project the DPE:

1. 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.

2. Ignores the fact that the weight of objections means the project has not earned a social licence from the communities.

3. Does not require evidence of, for example, claimed emissions reductions or electricity price reductions, expected economic life, or end-of-life responsibilities.

4. Does not impose conditions that address known issues, such as requiring soil and water testing before, during and after construction for the chemicals that leach from PV solar panels, which are declared as e-waste in Victoria and the EU because of their toxicity.

5. References the financial payments to be made to community groups and Council but ignores that the these payments are just a fraction of the $22.5 million to $29 million the project will receive annually from the Large-scale Generation Certificates (LGCs), which we all and our children and grandchildren will pay for through higher taxes and higher prices.

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.

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.

3. Failure to understand that the **BESS does not generate electricity** but is a significant consumer of electricity, which means it will increase both CO2e emissions and increase NEM system costs.

4. Failure to **consider both benefits and costs** to arrive at recommendation that is in the "*…public interest and appropriate*".

Each of the above points are discussed below.

## Embedded Greenhouse Gas Emissions (CO2e)

The Proponent avoids stating the capacity factor for its Oxley solar project and is vague on its expected life 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 the 215MWac capacity Oxley Solar Works is 29.9% [563,144MWhpa based on 81,000 households = 563144/1883400 = 29.9%] and a claimed life of 20 - 25 years (physical or economic?), which means that:

1. Where the PV solar panels and components are imported from matters but 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 3 to 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, 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 BESS and associated infrastructure.

   Therefore, it is evident that very substantial greenhouse emissions are embedded in the Oxley 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 400,000 tonnes of CO2 annually, which equals 0.71 tonnes of CO2/MWh of annual output [400,000t/563,144MWh]. 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 creates 90% less at just 0.13T/MWh. Over 10 years a HELE power plant that produced the same output as Oxley Solar [563,144MWhpa x 10] would only create a total of **0.732 million tonnes** [5,631,440 x 0.13] of CO2 in comparison with Oxley Solar upfront **four million tonnes, before accounting for the BESS**. 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 715,000 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 11,583 tonnes** [715,000 panels x 2kg Al x 8.1kg CO2e then converted to tonnes].

For one kilogram of steel the embedded CO2e is 2.75kg. If Oxley 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].

The 1190 B-Double and Semi-trailer trips between Newcastle Port and the Oxley Solar site would cover 1.9 million kms and burn nearly 900,000 litres of diesel and oil. About **2,367 tonnes of CO2e** would be created.

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 56,260 tonnes [(1,430,000kg 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. The BESS works will add more CO2e more frequently as it has a shorter life then 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 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 are being built now in many countries around the world, as are nuclear power plants. The Oxley solar project could not compete against a HELE plant that produces 90% less emissions, let alone a zero emissions nuclear plant, because the Oxley 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 20 - 25 years life.

   The proposed Oxley solar project therefore fails the first fundamental requirement that its must significantly reduce greenhouse emissions over its lifetime. As it claims annual CO2 savings of 400,000t of CO2 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 Oxley Solar and BESS 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 similarly refuse the Oxley 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 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 are about one third to a quarter 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 and wind generation capacity 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 Oxley 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 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 81,000 average 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 x 133.7kWh/week = 6952.4kWh = 6.952MWhpa].

7. The Oxley Solar project has a capacity factor of under 30%. The other 70% to almost 100% of the time or 16.8 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 replacing from 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 the these payments are just a fraction of the $22.5 million to $29 million the project receives annually from the Large-scale Generation Certificates (LGCs), which we all pay for through higher taxes and higher prices. These subsidies over decades not only return the capital cost to the Proponent but also funds the payments into "community benefit funds". This on-going burden will be carried through to future generations, which is contrary to the principle of "intergenerational equity".

9. The Proponent for the Oxley Solar project has not proven that the 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 and wind works are built. Then comes the replacements once the first projects come to the end of their relatively short life. Such replacements will need to be started years before decommissioning of an existing wind or solar works.

10. The Oxley Solar works will not result in lowering consumers electricity prices and therefore fails the second fundamental requirement that its 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 in the CWO REZ have been subjected to blackouts and brownouts for years. It will only get worse according to the recent AEMO warnings.

## BESS deficiencies

The Oxley Solar project proposal includes a Battery Energy Storage System or BESS for short. Not much is included in the proposal, mainly unsupported general statements about stabilising output from the solar panels and providing electricity in times of high demand. The DPE in its Assessment Report specifically states on roman numeral page ii the project includes *"...a battery storage facility with a capacity of 50MW/50MWh. Importantly, the battery would enable the project to store solar energy for dispatch to the grid outside of daylight hours and/or during periods of peak demand, which has the potential to contribute to increased grid stability and energy security."*

There is no critical assessment of the BESS element of the proposal to support the DPE's supporting conclusion. For instance:

1. The DPE states that the BESS "...*has the potential to contribute to increased grid stability and energy security."* Why is this uncertainty acceptable? What are the consequences for grid stability and energy security if the purpose for the BESS's existence is not achieved? How will the BESS be recharged when the solar works only produces electricity less than 70% of the time and sometimes virtually zero?

   The answer is that it must draw from the grid and so place added demand on

electricity generation elsewhere or not function at all until it can be recharged. The BESS is pushed as a solution to the intermittency and variability of output from the solar and wind generators. Yet a BESS can be no more reliable and available than these unreliable and intermittent sources of electricity generation. Or the BESS has to rely on the fossil fuel generators until they are all decommissioned. Then what?

2. At an initial capacity factor of under 30%, which declines at about 0.6% to 0.8% a year, the stated Oxley Solar project of 215MW capacity is 8% of the 2,640MW capacity of the 37 year-old coal-fired Bayswater power station, whose Capacity Factor is currently 66.5%. Yet Oxley solar will only initially and unreliably generate the equivalent of 3.7% of Bayswater's available on demand output.

3. Over the first full year of operation the Oxley solar works may on average only intermittently generate electricity under 30% of the time or an average of only 7.2 hours a day. But averages are misleading as most of the time the solar works will generate zero to a small amounts of electricity as sufficient sunlight to achieve full capacity output is not available most of the time. The other 70% to almost 100% of the time or 16.8 to nearly 24 hours a day electricity consumers will have to get electricity provided from other generating sources.

4. Those other electricity generating sources for some time yet will be provided by fossil fuels or increasingly rooftop solar and industrial wind turbines.

5. A BESS does not generate electricity. A BESS requires 20 - 30% more electricity to become fully charged than it can deliver back to the grid. This implies a bigger and bigger grid capacity is needed just to make up for the energy loss in charging more and more batteries. This massive need to overbuild the generating capacity significantly increases electricity costs and global carbon emissions. It also requires ever increasing amounts of raw materials and huge areas of usually agricultural and wilderness land.

6. Energy storage such as the proposed 50MW/50MWh battery energy storage system may only, if fully charged, supply the 81,000 households on average about 37 minutes if 20% charge is retained to extend battery life and to provide 24/7 power for the necessary safety requirements of the Oxley solar operations.

7. During peak electricity demand on a winter's evening the BESS may only supply a few minutes of energy per household. The primary purpose of the BESS is to stabilise the highly variable output generated by the solar panels and not to supply the electricity grid as claimed.

8. The economic and physical useful life of BESS batteries and some of the associated equipment, e.g., inverters, results in the total replacement every 7 - 13 years, sooner or later depending on the number of charge/recharge cycles that have occurred. This results in substantial toxic waste, significant increased replacement costs, higher electricity prices and increased carbon emissions. Yet none of this appears to be of

concern to authorities.

9. Just as the efficiency of solar panels decline over time so does a BESS. At one cycle a day the BESS will only hold about 76% of its capacity after 10 years. i.e. the Oxley BESS can be expected to be only equivalent to a 38MW/38MWh facility. Thus, more solar, wind and BESS projects will be required to offset those losses. Not good for the environment or future electricity prices.

10. SOS has already made submissions of up to 30 pages just for some BESS only proposals, which raise many more of the numerous problems with BESS facilities. Attachment "BESS Deficiencies V1" is an example of the issues raised.

    One such SOS submission resulted in the Proponent having to check and refine its output calculations. It had to amend the annual output stated in its EIS from 380,000MWh to 146,000MWh, an overstatement "error" of 234,000MWh or 260%. As the business of the stand alone BESS is to buy and sell electricity how can the project still be viable if the basis of its revenue is 260% less? There was no reduction in the capacity, equipment, land required, etc. to reflect the reduced output.

    Also, there would be adverse implications for sizing the NEM grid based on the original claim. After all, the most basic and fundamental purposes that are claimed for a BESS are output stabilisation and delivery of electricity to the grid. If huge incorrect claims about output can get through the planning process undetected and a project be approved then there are serious flaws in the process.

    The DPE recommended the project be approved and it was. This was despite this error and other issues that they did not identify but SOS did. Members of the affected communities should not be expected to uncover false claims, "errors, omissions, etc. that SOS continually identify when available time and our volunteer resources permit.

## 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 Oxley 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 and short lives and little detail of the BESS limitations are but three matters raised. Our two attachments expand on these and many other issues.

We disagree with the DPE's conclusion that the project is in the "*…public interest and appropriate*". 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 water truck 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 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,

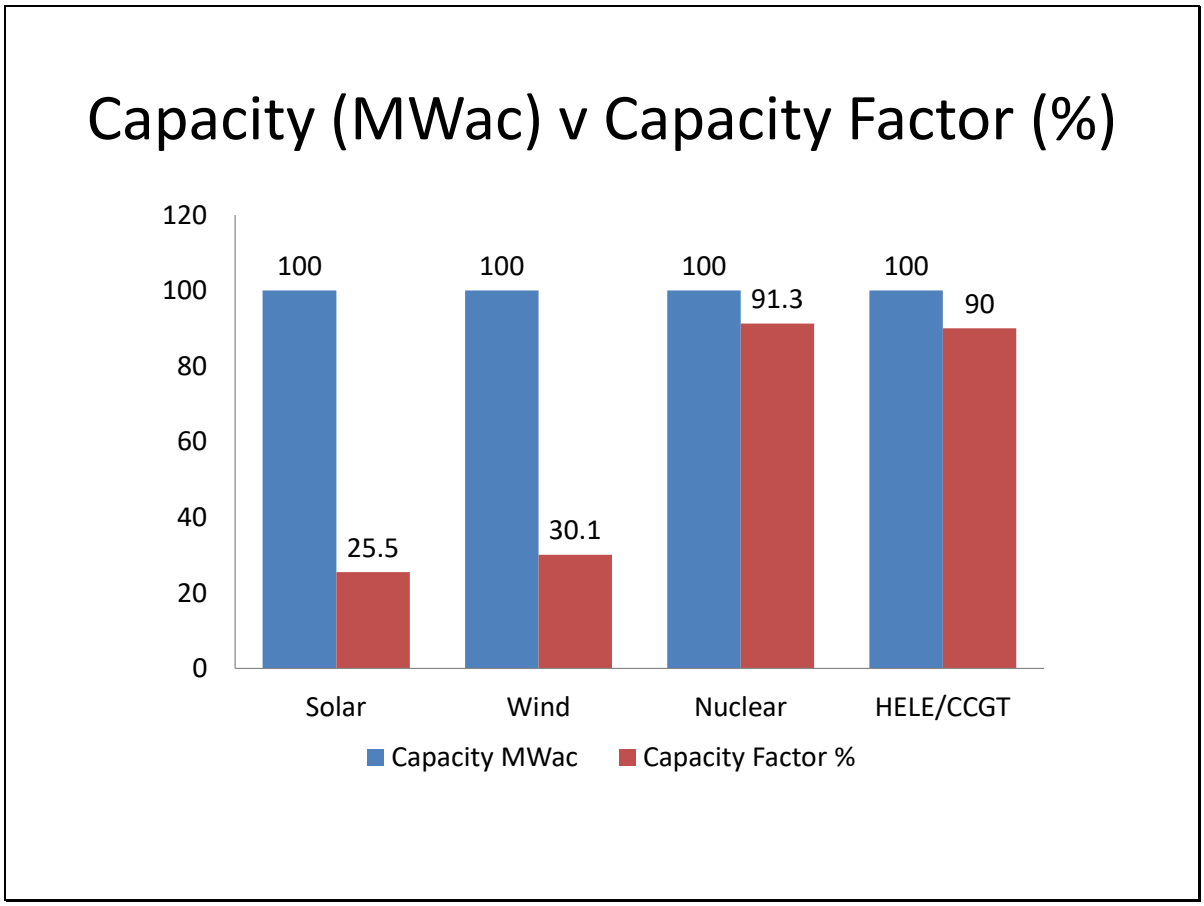
"*A significant proportion of the data used continuously draws upon outdated sources. ...*",

" *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, gas 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**. 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)

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