

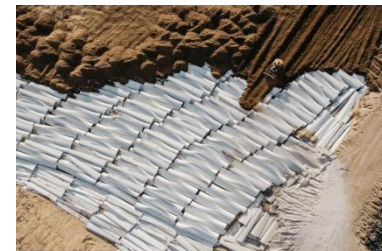
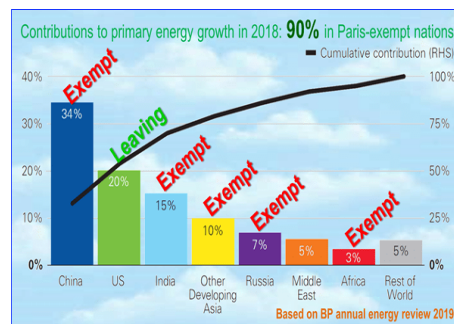
SOS (Save Our Surroundings)

Without Prejudice

A research paper prepared by SOS Central West NSW November 2020



Wind and Solar Electricity Generation Are The Answer. Seriously?



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Wind and Solar Electricity Generation are the best way to go. Seriously?

Written by Save Our Surroundings (SOS), a group of concerned citizens, Central West NSW Australia
Released November 2020

Introduction

Why SOS prepared this paper

On 3 August 2020 the NSW **Western Regional Planning Panel** determined that the proposed PV solar Industrial Electricity Generating Works (IEGW) was an unsuitable site near Gulgong town for several reasons. The Panel took into consideration the hundreds of written submissions against the proposal made during the public exhibition and those who addressed the Panel during the teleconference hearing. The Panel noted that the issues of concern included: visual impact; cultural heritage; acoustics; bushfire risk; potential contamination and; lack of economic benefit.

During the SOS group's 12 months campaign against this industrial development on the edge of Gulgong township a great deal was learnt about weather-dependent "renewable" energy developments (solar and wind). Most of what was learnt involved several thousands of hours of research and reading many thousands of pages of scientific papers, government documents, development proposals, news articles, various books and publications and real-life experiences.

"The public and the news media, who should be asking probing questions, have become convinced that they cannot understand science. They are reduced to asking scientists to spoon feed them sound bites. With a little work, most lay people can understand scientific papers and they should try. Relying on politicians, scientists, and the media to tell us what is happening is not acceptable."

Quote by Andy May "Politics and Climate Change: A History"; wattsupwiththat.com/2020/11/15/the-government-corruption-of-science/

The significant conclusions drawn from our research into weather-dependent wind and solar electricity generation, including the required backup using batteries and biomass, are that:

- Australian governments cannot achieve their stated objectives of reducing global temperatures, significantly reducing electricity prices and creating substantial numbers of jobs: no state or country with a large proportion of wind and solar in their electricity generation mix has achieved these objectives.
- The risks to the safety of people and the damage to the environment are substantial and are being ignored: risks include life-cycle toxicity, fires, loss of productive farmland, pollution of the environment and abuses of people in developing countries, including children; globally, 82% of mining areas are now targeted to extract raw materials for "renewables".
- Resources are being misallocated: up to ten times more resources are needed for intermittent weather-dependent renewables than for alternatives such as reliable base-load modern gas or nuclear generators; subsidies and favourable policies for renewables distort the market place for energy generation.
- The public are not being told about the many negative aspects of weather-dependent electricity generation or are being misled about the benefits; even so the public and community groups have rejected the case for excessive renewables several times already but our politicians continue to ignore the majority decisions by the voters.

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This paper presents many of our research findings in the hope that it will highlight folly of the Federal and State governments' policies in promoting and subsidising solar and wind electricity generating works at the expense of much better modern alternatives, such as HELE coal-fired power plants, combined closed cycle natural gas turbines and nuclear reactor electricity generation, which are all much less harmful to the global environment.

The two policy drivers promoted by governments to extensively change the methods of electricity production in Australia are:

- (1) to lower carbon dioxide emissions to reduce Earth's projected temperature increases, and
- (2) to provide a very low cost electricity supply so as to:
 - a) increase economic activity;
 - b) create sufficient jobs for an increasing population;
 - c) mitigate the impacts of the COVID-19 on Australia's economy, which resulted in an acceptable unemployment rate.

Therefore, the question to be answered is: "To what extent should weather-dependent renewables, and their necessary additional infrastructure and negative impacts on the environment and people, play in achieving these policies". Some people say 100%, such as the NSW State Liberal, Labor and Greens parties and many of the ill-informed public bodies, companies and main stream media, but our research demonstrates they must play a very small part if Australia is to recover economically.

Our justification for concluding that wind turbines and solar industrial electricity generating works (IEGW) should play a small part in Australia's total electricity generation mix derives from examination of the evidence, which does not support any of the claims made by those that advocate wind and solar electricity generation, including the necessary backup of battery and biomass plants. This research paper examines the claims by proponents that weather-dependent renewables:

- **significantly reduce CO2 emissions;**
- **provide the cheapest sources of electricity generation;**
- **create substantial numbers of jobs (especially in the regions);**
- **are safe;**
- **are good for the environment;**
- **are clean sources of energy;**
- **will eliminate fossil fuel use;**
- **have strong community support;**
- **are reliable;**
- **are sustainable.**

We will try to be brief but the topic and evidence is substantial and the research extensive, so at best we will only provide summary points at this time. We will address the claims for the benefits of wind and PV solar "renewables", including the claims that battery and biomass backup is all that is needed.

First, some definitions:

It is important that the reader understand the terms and acronyms used when discussing electrical energy. For instance, a photovoltaic (PV) solar Industrial Electricity Generating Works (IEGW) with a rated capacity of 400 megawatts (MW) produces less than the third of the electricity over a year than does a modern closed cycle gas turbine (CCGT) power plant or nuclear reactor. The electricity output of a power plant is described as megawatt hours (MWh). More detailed definitions are shown at Appendix A.

Second, some basic facts:

- It is estimated from IPCC data that human-induced carbon dioxide (CO₂) from all sources, not just electricity generation, is **3%** of the small amount of the CO₂ in the atmosphere. Australia is responsible for about **0.039%** (i.e. 1.3% of the 3%) of human-induced amount of total global emissions of carbon dioxide (generally stated as the main driver of global warming) and by signing the Paris Climate Agreement has undertaken to reduce its human related carbon dioxide emissions over time

However, Australia's Chief Scientist of Australia, Dr Finkel, told the Senate in June 2017 that if Australia reduced its **total** carbon emissions to **zero**, that it would do **virtually nothing to reduce global temperatures**.

Thus, Australia's policies on emissions reductions should be based on logic and practicality. For Australia, electricity consumption is about **39%** of our total energy consumption, i.e. much less than half of our total CO₂ emissions. Restructuring our electricity system can have no affect on our climate.

There is no justification for spending multi-billions of dollars every year in direct and indirect subsidies for no climate benefit, yet causing higher electricity bills, increasing hardship to Australians, damage to our economy and wide-scale damage to our environment, both in Australia and overseas.

[ref: <https://www.facebook.com/SenatorIanMacdonald/videos/1343186319100574/>; IPCC AR4 2007]

- Every country, such as Australia, Germany and Denmark or state, such as California and South Australia, that have significantly introduced solar and wind technologies into their electricity generation mix have not only significantly increased their electricity prices but also destabilised their electricity grids, which leads to more expenditure on 100% backup, extension of transmission lines and more difficult grid management.

Doing more of the same thing (i.e. increasing the percentage of weather-dependent renewables) and expecting a different result is totally illogical.

[ref: [afr.com 5/8/17 "MarkIntell, US Energy Information Administration"](https://afr.com/5/8/17/MarkIntell,USEnergyInformationAdministration/)]

- The NSW Government in November 2019 declared the Central-West a Renewable Energy Zone (C-W REZ), which will be a **3,000MW** installed capacity pilot for two other NSW Renewable Energy Zones. The NSW Electricity Strategy states it aims are to provide low cost electricity to consumers and provide a stable and reliable energy system, while achieving a net-zero emissions target by 2050. *"For households, the Strategy will lead to estimated bill savings of \$40 per year " by 2040.* Really?

The current average residential bills are: **18-29yo \$1906; 60syo \$1458**. We need to reduce electricity bills by **half or more not a miniscule \$40 or even \$130 in 20 years' time**. No country or state so far has been able to have a high percentage of renewables in their electricity system mix and still provide cheaper electricity or even a stable or reliable supply. Australians already support renewables through direct and indirect subsidies and other means to the tune of **\$1300pa** per household, amounting to over **\$13 billion** nationally each year.

Use of the renewables subsidies to build two or three modern long-life HELE coal-fired (China, India, Japan and others are building more right now) or combined-cycle gas fired and/or nuclear plant (50 nuclear reactors are globally under construction right now) and the average electricity bills will drop by meaningful amounts within in a few years.

[ref: <https://energy.nsw.gov.au/media/1921/> " NSW Electricity Strategy"; [afr.com 5/8/17 "MarkIntell, US Energy](https://afr.com/5/8/17/MarkIntell,USEnergy)

Information Administration"; [afr.com 5/8/17 "MarkIntell, US Energy Information Administration"; 23/08/20 Report by Dr Moran "The Hidden Cost of Renewables on Electricity Prices"; \[ddears.com/2020/07/14/dont-ignore-coal/\]\(#\) ; \[world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx\]\(#\) Daily Telegraph p2 9/11/20 "Road to cheaper and cleaner power in NSW" \]](#)

- Two of the biggest emitters of CO₂ in 2018 were China (**27.8%**) and India (**7.3%**) who, under the Paris Climate Agreement, can continue to increase their emissions for several more decades. The USA, while the second biggest CO₂ emitter in 2018 (**15.2%**) has reduced its emissions by **12.1%** since Kyoto Protocol commenced in 2005, largely by significantly increasing gas for electricity generation instead of using coal. In 2019 China's emissions rose despite a slower economy, increased renewables and the full-year operation of seven large-scale nuclear reactors.

Australia can have no practical effect in reducing global CO₂ emissions.

[ref: "2019 BP Statistical Review of World Energy"; Paris Agreement targets; [iea.org/articles/global-co2-emissions-in-2019](#) ; <https://www.facebook.com/SenatorIanMacdonald/videos/1343186319100574/> ;]

- Germany and Denmark are regarded as world leaders in transitioning to renewable energy electricity generation, yet in 2019 Germany had the highest electricity prices (**US\$0.381/KWh**) in the world with Denmark second (**US\$0.361/KWh**), despite their massive shift to renewables at **46.5%** and **63%** respectively; the world average electricity price in 2019 was **US\$0.14/KWh** , Australia was **US\$0.242** and, China and India, who generate most of their electricity from using coal, were each **US\$0.08/KWh**.

The evidence is clear: the more weather-dependent renewables there are the greater the increase the overall cost of electricity supply. How can Australia be competitive when our electricity cost three times more than our competition?

[ref: [globalpetrolprices.com "Electricity prices for households, December 2019"](#).]

- For energy generation, wind is an ancient technology and solar cells (invented in 1883 by C Fritz) and the first viable solar panel developed by Bell Laboratories in 1953, are both dilute inefficient and inconsistent forms of energy conversion. The energy density (amount of energy in mega-joules [Mj] released per kg) of different fuels in increasing order is wood (16Mj/kg), coal (24), oil (45), natural gas(55) and nuclear (3,900,000). The higher the energy density the lower the total demand on all resources and the higher the efficiency in producing electricity. A mega-joule is equivalent to 0.278KWh of energy.

Logically, natural gas and zero emissions nuclear are the preferred fuels at this time.

[ref: [understandsolar.com "Who invented solar panels?"](#); [energyeducation.ca/encyclopedia/energy_density](#)]

- A study of Germany's electricity generation found that over their operating life solar and wind have very low energy output compared to the energy used to make and install them. The energy generated by nuclear, hydro, wind and solar was, respectively, **75, 35, 3.9** and **1.6** times greater than the energy required to make them. Wind and solar provide a poor return on an energy in/energy out basis compared with other methods.

Logically, nuclear energy should be preferred as it gives the best energy result.

[ref: [30/6/20 M Shellenberger "Apocalypse Never" p192](#)]

- Australia is the only country of the top 20 developed countries and the top 'developing' countries (China, India) that do not depend on zero-emissions nuclear power for part of their electricity generation. There are currently about **50** nuclear power reactors under construction, mainly in China, India, Russia and UAE.

Australia is being left behind due to its illogical and damaging ban on nuclear energy.

[ref: [World Nuclear Association "Plans for New Reactors Worldwide" September 2020](#)]

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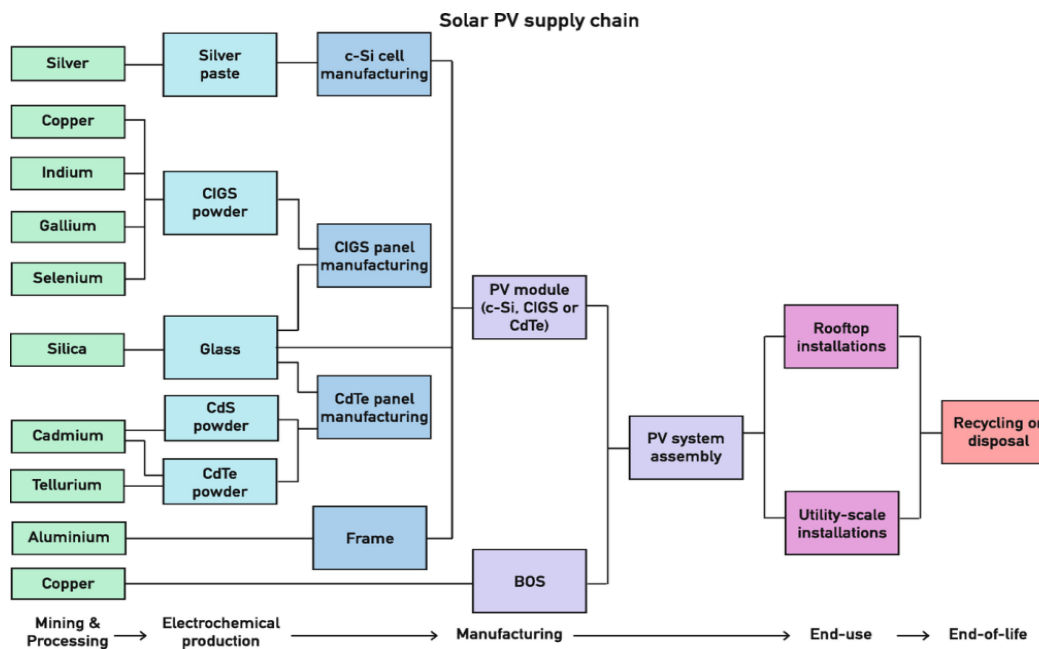
- California at the end of 2019 had 13 in-state sources of electricity (excludes over 30% imported from interstate); installed capacity (MW) was PV solar **14.1%**, wind **7.5%**, natural gas **50.6%**, nuclear **3%**, hydro **17.6%**, others **7.2%**. California, America's most populous state, is among the most expensive states for electricity and its electricity prices have increased at five times the average rate of the rest of the USA as they move each year to higher percentages of "renewables" and elimination of fossil fuels and nuclear power sources. **Again, gas and nuclear should be the preferred power sources for Australia, especially as they do not involve major changes to the electricity grid or place huge demands on scarce resources as do weather-dependent renewables.**
[ref : 2001-2019 www.energy.ca.gov "Electric Generation Capacity and Energy"]

Claimed benefits of solar and wind electricity generation, i.e. these "renewables":

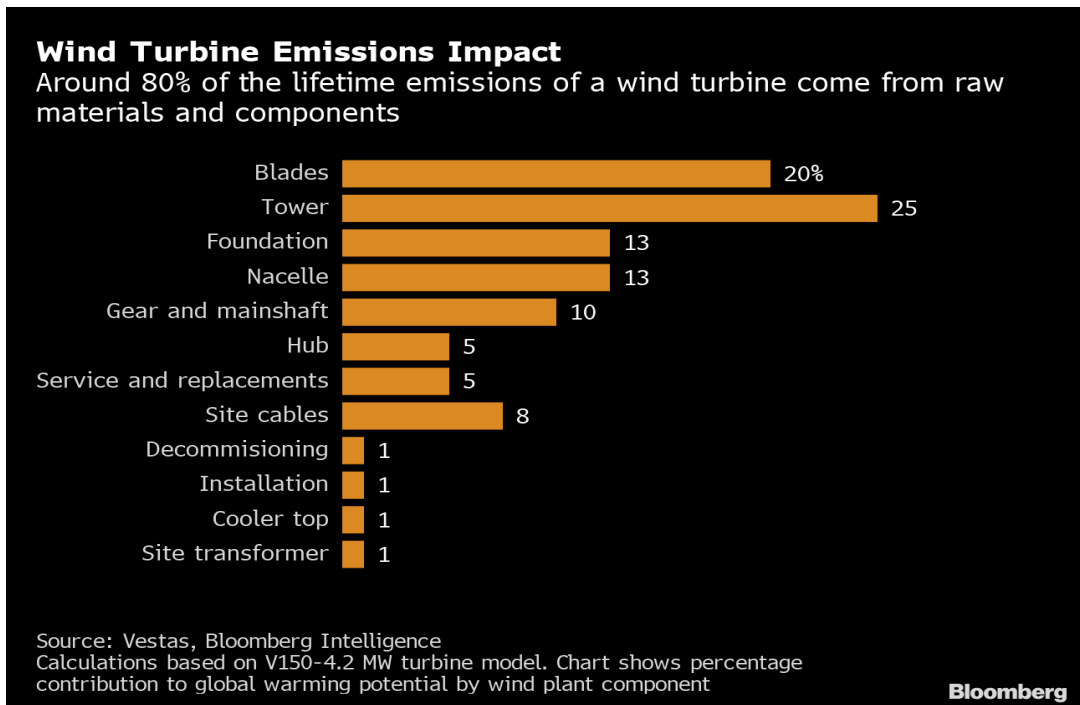
1. Significantly reduce CO₂ (or CO₂ equivalents) emissions

This claim is not supported by the facts, as advocates omit the multitude of associated emissions that weather-dependent renewables cause over their total short life-cycle, such as:

- Studies show, if the TOTAL life-cycle (e.g. mining, processing, manufacturing, transportation, land acquisition/lease, land clearing, construction, operation, decommissioning and disposal/recycling) of an industrial PV electricity generating system and the associated extra supporting infrastructure needed (e.g. backup power/storage, grid building/upgrades, substation building/upgrades, recycling facilities/storage, landfill facilities), creates substantially more CO₂ emissions than say a nuclear power plant of the same nameplate capacity (megawatts). Only about **60%** more energy is generated over the claimed up to **30** years life of an industrial PV solar plant than it takes to build it. Nuclear generates about **7,400%** more energy than it takes to build it and operates for up to **80** years.
[ref: 30/6/20 Michael Shellenberger "Apocalypse Never" p192; Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"]



- Studies show, if the TOTAL life-cycle (e.g. mining, processing, manufacturing, transportation, land acquisition/lease, land clearing, construction, operation, decommissioning and disposal/recycling) of an industrial wind turbine electricity generating system and the associated extra supporting infrastructure needed (e.g. manufacture of large specialised vehicles & cranes, road building, backup power/storage, grid building/upgrades, substation building/upgrades, recycling facilities/storage, landfill facilities), creates substantially more CO₂ emissions than say a nuclear power plant of the same nameplate capacity (megawatts). Only about **290%** more energy is generated over the up to **20** years life of an industrial wind turbine system than it takes to build it. A nuclear plant generates about **7,400%** more energy than it takes to build it.
[ref: 30/6/20 M Shellenberger "Apocalypse Never" p192; Bloomberg "Wind turbines emissions impact chart"]



- The relatively short life-cycle of PV solar systems (20 to 30 years) and wind turbines (15 to 20 years) and batteries (10 years) compared to the alternatives of coal, gas and nuclear plants (60 to 80 years) means that a PV solar plant or a wind turbine plant needs to be replaced/upgraded 2 to 3 and 4 to 5 times respectively during the lifetime of the alternatives, which generates more green house emissions each time. Over a 60 years period this frequent replacement of solar and wind electricity plants will continue adding CO2 to the atmosphere and drive up electricity prices for decades.
[ref: 17/08/20 "The excess cost of weather dependent renewable power generation in the USA" from EDMHDOTME]
- The low starting and declining efficiencies of wind turbines (**34%/1.6%pa**) and PV solar panels (under **25%/0.5 - 0.8%pa**) means that the initial resource demands of the installations has to be many times more than the alternatives for the same actual electricity generation output (megawatt hours pa) over life-times and so adds CO2 to the atmosphere.
[ref: sciencedirect.com Vol 66 June 2014 p775-786; 7/07/18 wholesalesolar.com "How long do solar panels last?"; 2012 NREL study]
- Despite very significant expenditures on renewables, Germany (**A\$830 billion** since 1999) and the state of California (**A\$143b** on wind & solar) have not met/may not meet their emission reduction targets as at 2019. Germany, whose emissions reductions have been flat for several years, will miss its 2020 target by **7 to 11%**. California has to nearly double its rate of CO2 reduction in the next decade compared to the previous decade.
[ref: nextbigfuture.com/2019/11/france-spent-less-on-nuclear-to-get-about-double-what-germany-gets-from-renewables; forbes.com/sites/michaelshellenberger/2020/08/15/why-californias-climate-policies-are-causing-electricity-black-outs/#6cf13471591a ; dw.com.en.germany " Germany unlikely to meet carbon reduction targets for 2020"; 16/1/20 mercurynews.com "California's behind on its 2030 climate goals. What's at stake if it doesn't catch up?"]
- Had California spent an estimated **US\$100 billion** (A\$143b) on nuclear instead of on wind and solar, it would have had enough energy to replace **all** fossil fuels in its in-state electricity mix. Thus, emissions-free nuclear reactors would have seriously reduced CO2 emissions and lowered electricity prices, as is the case in France, which generates about 70% of its

electricity from its nuclear reactors.

[ref: [15/8/20 forbes.com/sites/michaelshellenberger/2020/08/15/why-californias-climate-policies-are-causing-electricity-black-outs/#6cf13471591a](https://www.forbes.com/sites/michaelshellenberger/2020/08/15/why-californias-climate-policies-are-causing-electricity-black-outs/#6cf13471591a)]

- Sulphur hexafluoride (**SF6**) is a synthetic greenhouse gas primarily used for insulating electrical connections to the grid. **SF6 is 23,500** times more potent than CO2 and its estimated lifespan in the atmosphere is over 1000 years, whilst CO2 is 100 years. SF6 in the atmosphere has more than doubled in the last two decades and will continue to rise as more renewable energy connections to electricity grids occur.

[ref: [bbc.com 13/09/2019 "Climate Change: Electrical industry's dirty secret"](https://www.bbc.com/news/13/09/2019)]

- According to US federal data, building solar panels significantly increases emissions of nitrogen trifluoride (**NF3**), which is **17,000** times more potent than carbon dioxide as a greenhouse gas over a **100** year time period. NF3 emissions increased by **1,057 percent** over the last **25** years. In comparison, US carbon dioxide emissions only increased by about 5% during that time period. A significant and growing proportion of NF3 emissions is due to the manufacture of solar cells.

[<https://wattsupwiththat.com/2018/12/23/solar-panel-waste-a-disposal-problem/>; Wikipedia "where is NF3 used]

- A study has shown that a PV solar system only generates **1.6** times the energy that was used leading up to its commissioning. It therefore starts operation with a CO2 and energy deficit. Assuming a 25 year life then the system will only offset its energy deficit at the time of commissioning after 10 years of operation, i.e. **40%** of its life before contributing to any global reduction in CO2.

[ref: <https://doi.org/10.1016/j.energy.2013.01.029>]

- It was been calculated in 2014 that just the footing for a small (1MW) wind turbine requires **45** tons steel rebar and **481m3** of concrete, which produces **241.85 tons of CO2**. The CO2 produced from mining, processing and transporting the materials was **not** included in the calculation. 241.85 tons (219.4Tonnes) of CO2 is equivalent to an average new petrol driven car in 2017 (0.1201kg/km of CO2) travelling 1,827,000km or 122 cars each travelling 15,000km in a whole year.

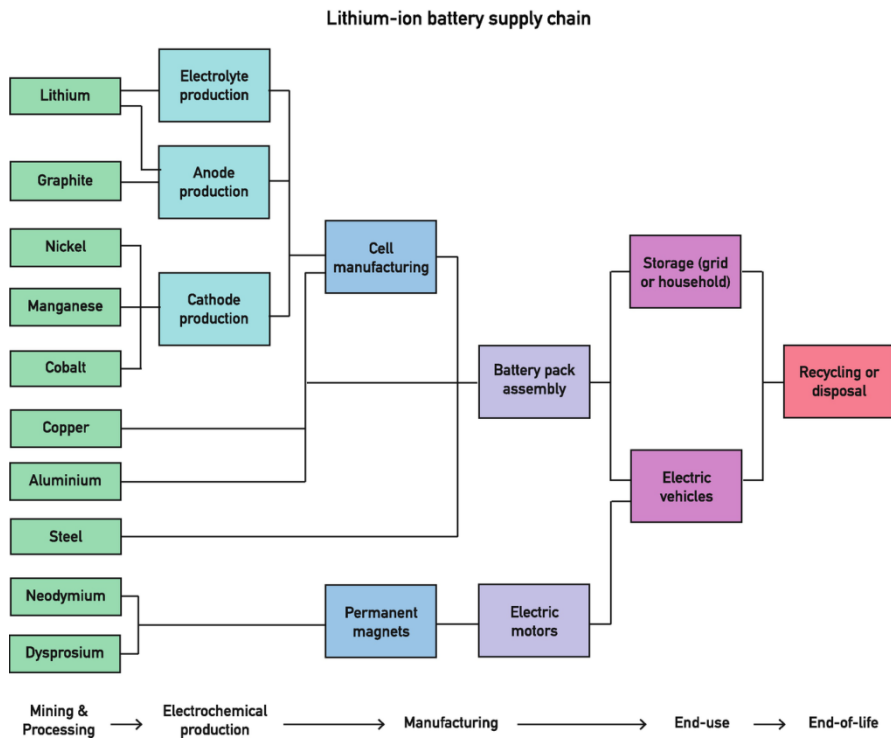
[ref stopthesethings.com 16/8/14 "How much CO2 gets emitted to build a wind turbine?"; 4/10/17 www.lightfoot.co.uk "How much CO2 does a car emit per year"]



A single wind turbine concrete base under construction

- Energy totalling **10-18MWh** is required to build one Tesla **850kg/85KWh** car battery, resulting in **15-20 tons of CO₂** emissions assuming 50 per cent renewable power. Assuming conservatively that 1-2 per cent of mined ores end up in the battery in the form of metals (see diagram below), one Tesla battery requires **25-50 tons** of raw materials to be mined, transported and processed.

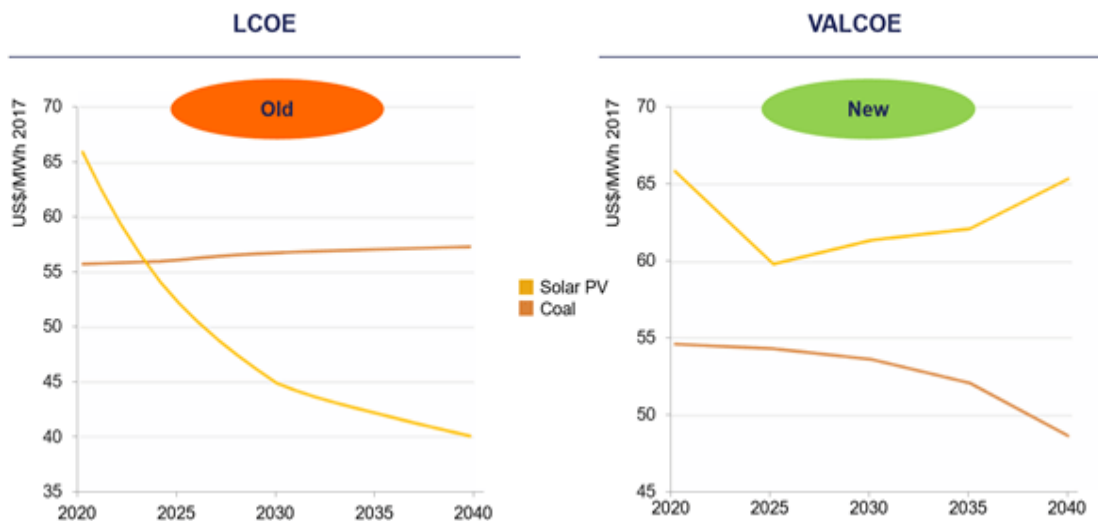
[ref: Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"]



2. Are the cheapest sources of electricity generation

This claim is not supported by the facts, and actually the opposite is true based on real world experiences, such as:

- The **Levelised Cost of Electricity (LCOE)** measure used in the popular press and by most governments is misleading. The still incomplete but better **Value-Adjusted LCOE (VALCOE)** from the IEA was first published in 2019. In January 2020 the prestigious Institute of Energy Economics Japan (IEEJ) published its 280-page 'IEEJ Energy Outlook 2020' and raised concerns about renewables' rising unaccounted-for integration costs, concluding that LCOE is not capable of capturing the true cost of wind and solar. Comparisons of alternate costs using VALCOE helps explain why electricity systems that have significant weather-dependent renewables in their mix have higher electricity prices than those that don't.
[ref: Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"; www.iea.org/data-and-statistics/charts/levelised-cost-of-value-adjusted-lcoe-valcoe-for-solar-pv-and-coal-fired-power-plants-in-india-in-the-new-policies-scenario-2020-2040]



IEA chart

- In South Australia, Wholesale Electricity prices increased from an average of **\$52.60 to \$109.80/MWh** when the Northern power plant was closed in 2015 and, in Victoria, on the closure of Hazlewood power plant in 2017 from **\$51.50 to \$97.90/MWh**. If coal-fired power stations are claimed to be more expensive than solar and wind why do average wholesale prices rise when they are closed down or policies applied that reduce their efficiency?
[ref: "Life-cycle energy densities and land-take requirements of various power generators: A UK perspective: 18/02/2016"]
- A comparison of retail electricity prices emphasises the disadvantage Australia has already created for itself with its high penetration of weather-dependent renewables. The more weather-dependent renewables the higher the electricity costs. A study of 2017 retail electricity prices in cents/KWh shows Australia's four NEM states ranked in the top nine highest electricity prices in the world, namely: **South Australia 47.13**, Denmark 44.78, Germany 43.29, Italy 40.30, **NSW 39.10**, Ireland 35.82, **Queensland 35.69**, Portugal 35.07, **Victoria 34.66**. In 1990s Australia had the lowest electricity prices in the world. Closing coal-fired power stations and substituting renewables has contributed to the increased rise.
[ref: afr.com 5/8/17 "MarkIntell, US Energy Information Administration"; Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"; www.statista.com/statistics/263492/electricity-prices-in-selected-countries/ 2018]



- In 2019 Germany's electricity production mix was **24.6% wind, 9.0% solar**, 8.6% biomass, 3.8% hydro, 29.1% coal, 10.5% gas, 13.8% nuclear, resulting in the highest household electricity price of any country in the world at **US\$0.381/KWh**, despite 46.0% (**33.6% wind and solar**) generated from renewable sources. This pattern of substantial increases in electricity prices appears to occur in all countries and states that have significantly increased their reliance on weather-dependent renewables.

[ref: www.ise.fraunhofer.de/news January 15 2020, p2; globalpetrolprices.com "Electricity prices for households, December 2019"; Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"]
- In 2019 Denmark's electricity production mix was **57% wind, 3% solar**, 20% biomass, 20% fossil fuels, resulting in the second highest domestic electricity price in the world at **US\$0.361/KWh**, despite **60%** generated from weather-dependent renewable sources. This pattern of substantial increases in electricity prices appears to occur in all countries and states that significantly increase their reliance on weather-dependent renewables.

[ref: globalpetrolprices.com "Electricity prices for households, December 2019"; https://en.wikipedia.org/wiki/electricity_sector_in_denmark]
- In 2019 Australia's electricity production mix included **21%** of renewables and its average domestic electricity price was **US\$0.246/KWh**, which already puts it in the high end of world prices where the 2019 average was only **US\$0.14**, with China and India only **US\$0.08/KWh** , who both predominately use coal-fired electricity generation. This pattern of substantial increases in electricity prices appears to occur in all countries and states that significantly increase their reliance on weather-dependent renewables.

[ref: globalpetrolprices.com "Electricity prices for households, December 2019"; 26/05/20 energy.gov.au/publications " Australian statistics table O electricity generation by fuel type 2018-19 and 2019]
- Energy Australia increased its household electricity rates by **1.7%** and reduced its rooftop solar feed-in tariff by **16%** in January 2020 for Gulgong NSW consumers, despite the nearby Beryl PV electricity generating works (3rd largest in NSW) becoming operational in May 2019. The reason given for the increase was "supply costs have increased significantly"

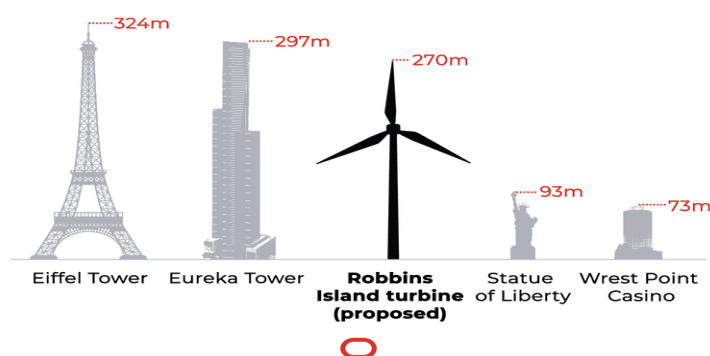
despite several solar and wind industrial electricity generating works (IEGW) already operating in the Central West NSW region.

[ref: a resident's EA notification of changes to their base rates]

- Energy Australia, which is a major retail electricity distributor, did not pay any company taxes for years as they have not generated profits on their **\$30 billion** in revenue 2013-2017. They also own power stations, mines and wind IEGWs. Electricity prices will have to rise if profits are to be made.
[ref: michaelwest.com.au/energy_australia_four_years_30_billion_zero_tax]
- Renewables in Australia have direct and indirect subsidies and loans by various levels of state and federal governments amounting to **\$13 billion a year or \$1300 per household**, yet electricity prices continue to rise and will continue to do so unless base-load power is put in place urgently. To put this expenditure in perspective, the JobKeeper scheme as part of the Government's response to the COVID-19 pandemic cost \$13 billion to support 3.3 million jobs to the end of June 2020. **\$13 billion** would also pay for three **250MW** combined cycle gas-fired power plants every year. Such plants are very efficient, flexible, provide base-load power, are quick to build with low resource demands compared with wind and solar IEGW.
[ref: 23/08/20 Dr Moran "The Hidden Cost of Renewables on Electricity Prices"; smh.com.au 14/06/20 Infrastructure to get \$1.5 billion boost and priority list"; finance.nine.com.au/business-news/agl-to-build-400m-gas-fired-power-plant/0ea6303e-65df-4c8d-b501-0cb52aa0d197]
- Germany is now facing the prospect of replacing/decommissioning **5,700** (4.5GW capacity) of its **28,000** wind turbines in 2021 alone. Decommissioning just one wind turbine, without removing most of the enormous concrete footing, costs about **US\$532,000**, while replacing with a new wind 3MW turbine costs about **US\$3.9 million** plus transport and installation costs. Such frequent decommissioning and replacement costs are not reflected in the kWh price comparisons of renewables electricity against the alternatives using the Levelised Cost of Electricity (LCOE) method.
[ref: weatherguardwind.com 24/3/20 "Wind turbine cost: How much? Are they worth it in 2020": insituteforenergyresearch.org 2/11/19 "The cost of decommissioning wind turbines is huge"; stopthesethings.com 14/11/17 "Kaput!: German Wind Farms set for dismantling as subsidies dry up"; Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"]
- Although electricity is available in a road in Gulgong NSW, a new owner has to spend over **\$30,000** to have it connected to their small rural property. The extra pole and transformer, which they had to buy, became the property of the electricity infrastructure provider. So the land owner paid for the additional infrastructure, while the renewables local and overseas developers, who get various types of government subsidies, do not contribute to the grid upgrades/construction that are only needed because the installation of weather-dependent renewables create the need for it. These costs of extra infrastructure, which can be for each additional MW of generating capacity, cost **\$275,000/km to \$660,000/km** just for the high voltage transmission lines. Such extra costs are passed onto the consumer, which helps explain why electricity prices rise as more weather-dependent renewables are installed.
[ref: www.transgrid.com.au/news-views/publications/ "Transmission annual planning 2018" p28 Table 14]
- On 4/11/20 it was reported that the estimated cost of the proposed **900km** electricity inter-connector between Robertson SA and Wagga Wagga NSW had gone from **\$1.53 billion to \$2.43 billion**, most of which will get passed onto mainly NSW consumers. How did Transgrid and ElectraNet get their initial estimate so wrong?
[ref: https://www.transgrid.com.au/news-views/publications/ "Transmission annual planning 2018" p28 Table 14; The Daily Telegraph 4/11/20 page 4]

- The relatively short life-cycle of PV solar systems (20 to 30 years) and wind turbines (15 to 20 years) compared to the alternatives of coal, gas and nuclear plants (60 to 80 years) means that a PV solar plant or a wind turbine plant need to be replaced/upgraded 2 to 3 and 4 to 5 times respectively during the lifetime of the alternatives, which generates more costs into the electricity network each time. Over a 60 years period this frequent replacement of solar and wind plants will continue driving up electricity prices for decades. One study shows that wind and solar over **60 years is SIX** times more costly per 1,000MWh than natural gas combined cycle turbine technology.
[ref: 17/08/20 "The excess cost of weather dependent renewable power generation in the USA" from EDMHDOTME]
- While wind turbines are getting bigger and solar panels cheaper to make, as well as more energy conversion efficient, the cost of electricity to consumers is not falling. The reasons for this appear obvious: land acquisition, transport and construction costs are increasing; 100% duplication by alternate backup generation; inefficient use of base-load coal and gas-fired power plants to backup the grid supply when the renewables outputs are low or zero; rising costs of extending and modifying the electricity grid to connect renewables; increased complexity of managing the grid due to instability caused by renewables' variable output; high level of subsidies even though renewables are a mature industry with over 20 years of field operation; the introduction of high cost, short-life batteries for short-term stabilisation of renewables plant output; frequent replacement of end of life renewable installations and battery backup; high increasing maintenance costs of wind turbines; very high costs of decommissioning renewables plants and disposing of their waste, some of it toxic.
- For example. The proposed **\$1.5 billion** wind IEGW for Robbins Island and Jim's Plain Tasmania will involve **163** turbines up to 270m tall for a nameplate capacity of up to **900MW**. For the project to go ahead the developer requires to be built: a bridge between the island and the Tasmanian mainland; a **500** metre wharf at the island; **115km** of new 220kV transmission lines; a new substation; the Marius Link Interconnector undersea cable to Victoria at about \$1 billion plus. A direct link to Victoria at \$1.5billion to \$2Billion would have made the project unviable and so was abandoned by the developer. The amount of government (taxpayers) subsidies is unknown but for another project it was stated as **\$660,000 per turbine per year**, therefore the subsidy could total \$1.1 billion over just 10 years. So in reality, the project's viability depends on \$billions being spent by others (i.e. taxpayers, other consumers). No wonder Australia's electricity prices are near the highest in the world and can't come down anytime soon with years' of committed subsidies.
[ref: robbinsislandwindfarm.com/projects/; 3/7/20 skynews.com.au/details/_6169082592001 "Taxpayers 'taken for a ride' with subsidised windfarm"; Bing search - pics of wind turbines from theconversation]

The proposed Robbins Island turbine height in comparison



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- C Millis, a USA Carolina state representative was the lead sponsor of House Bill 745, which required proper decommissioning of utility-scale solar plants after they close, reclamation of the land to its original condition within two years, and posting financial guarantees to ensure the work gets done. For example, he said, a 3 megawatt project in Sacramento County, Calif., cost owners US\$220,000 to clean up even after they got US\$375,000 for recycled materials. A 20 MW solar project in Maryland cost **US\$2.1 million** to remove *after* recycling revenue.
In Central West NSW alone we have several solar plants in place or proposed with capacities ranging from 11MW to 400MW where the cleanup cost will be astronomical. No bonds are required or guarantees that restoration will occur. Another cost that will be borne by the electricity consumer or local rate payers if the company or land holder fails to properly clean up the site.
[\[ref: carolinajournal.com/news-article/environmental-hazard/ "Moore County residents worry about solar's long-term environmental impacts - Carolina Journal"\]](http://carolinajournal.com/news-article/environmental-hazard/)
- The Lancet study, as with many other studies over the years, found that **6.5%** of deaths in Australia are due to cold weather while only **0.5%** of deaths are due to hot weather. In 2010-11 over **200 people a day died** during winter because they could not afford to heat their homes. High electricity prices cause many people to forego heating, resulting in premature death. In 2018 one charity provided **55,000** winter garments to Australian "families who can't afford to run their heating". Australia must get back to electricity prices near the cheapest in the world, as in the 1990s.
Weather-dependent renewables cannot achieve this life-saving goal.
[\[ref: theconversation.com/cold-weather-is-a-bigger-killer-than-extreme-heat-heres-why-42252;](http://theconversation.com/cold-weather-is-a-bigger-killer-than-extreme-heat-heres-why-42252)
[theguardian.com/society/2011/oct/22/older-people-cold-energy-bills;](http://theguardian.com/society/2011/oct/22/older-people-cold-energy-bills) Daily Telegraph 9/11/20 editorial p40]

3. Create substantial numbers of jobs (especially in the regions)

This claim is not supported by the facts, logic or real world experience, such as:

- Experience with the Beryl 87MWac PV solar electricity generating works constructed near Gulgong NSW in early 2019 clearly highlights that virtually no local jobs were involved in the five months of construction. Of the claimed **150** 'construction workers' involved, nearby residents and businesses said that the majority were bussed-in, lowly paid, backpackers. There is only one full-time employee onsite during operation. Small (about 3 full-time equivalents) roaming maintenance crews are brought in if needed. So much for local jobs.
[ref: 10/17 NSW P&E State Significant Development Assessment Report Table 1; 2019-20 Gulgong/Beryl residents' and business owners' comments; Daily Telegraph 6/11/20 p15 "Clean energy farm a fatal risk"]
- The DA for the PV electricity generating works proposed for Old Mill Road Gulgong stated that up to **50** construction workers would be required for a few months and would be bussed-in if needed, and that **2 to 4** maintenance workers would visit the site every three months and there would be no onsite workers once operational. So much for local jobs.
[ref: Developer's submission to MWRPP August 2020, DA0283/2019]
- A PV solar IEGW being built in Wellington Central West Region currently employs **560** construction workers but the union said the workforce was "**primarily** made up of **backpackers** hired through contractors". A visit by SOS members also discovered that even the closest coffee shop was staffed by overseas backpackers. So much for local jobs.
[ref: Daily Telegraph 6/11/20 p15 "Clean energy farm a fatal risk"]
- Huge areas of agricultural land just around Gulgong will be lost for decades. Land has already been taken for Beryl IEGW (310ha) and the proposed Stubbo IEGW (1750ha, which is equal to the land area of the new Western Sydney airport) and the other PV solar IEGW (850ha).
This loss of land, which were/can be used for agriculture and grazing stock, reduces the ongoing job opportunities for Gulgong area local workers and businesses, such as those involved in farm fencing, machinery supply, equipment maintenance, irrigation, sheep shearing, hay baling, chemicals supply/dispersion, provisions, fertiliser, feedstock, hardware supplies, goods and animal transport, sales yards, hay baling, etc, and the support services (accommodation, food, entertainment, health services, etc) or, for permanent residents that live on the land, all the associated services (building, plumbing, electrical, etc). These solar IEGW will take the agricultural/grazing/residential land out of alternative use for 20 to 30 years and will provide virtually no local employment benefits over that time, but jobs elsewhere will be diminished. So much for local jobs.
- Once the upright supports for a solar industrial electricity generating works (IEGW) are pile-driven into the ground the assembly of the cross-members and attaching of each imported PV panel (two person activity) are very low skilled jobs required for only a few months duration, hence the use of backpackers and unskilled labour where possible. How much of the project \$millions cost is Australian content? So much for local jobs.
[ref: <https://www.youtube.com/watch?v=KjliTjs2fjw>; 8/9/20 SOS members' solar IEGW site/ town visit discussions with backpackers at Wellington NSW; www.dasolar.com/solar-panel-installation/solar-farms]



Land cleared. cables laid. pile-driven uprights in place



Crew of two install cross-members and panels

- Wind turbines cannot be major creators of jobs for Australians as all wind turbines are made overseas (e.g. Denmark, Spain, China, USA). In addition, most of the mined raw materials, material processing, component manufacture, transport by ship, specialised road transport and cranes also occurs overseas. How much of the project \$millions of cost is Australian content? We suggest not much. So much for local jobs.
[ref: 26/5/20 bizvibe.com "Top 10 wind turbine manufactures in the world 2020"]
- PV solar systems cannot be major creators of jobs for Australians as they are nearly all made overseas (mainly China), including most of the mined raw materials, material processing, component manufacture, transport by ship and often construction labour (e.g. backpackers). How much of the project \$millions of cost is Australian content? We suggest not much. So much for local jobs.
[ref: 2020 solarclap.com "Top 10 Solar Companies in the World"]
- The measure of job creation for Australia must be the net jobs gain or loss as renewables are promoted as a substitute for coal mining and gas extraction, which are things that directly employ many tens of thousands of Australians in well paid jobs. They also provide substantial export, company tax and royalty income, which gets reinvested into the Australian economy and contributes to the health, education and welfare services Australians receive. Once installed, weather-dependent renewables produce no export or royalty income and employ few people, so increasing the burden on productive businesses, taxpayers and electricity consumers.
[ref: abc.net.au 11/7/19 "Are there really 54,000 people employed in thermal coal mining"; statista.com/statistics/1120570 5/6/20 " Australia - Export value of coal 2019"; Deloitte report 26/3/19 "Estimates of payments of royalties and company tax in 2017-18";]
- An in-depth study in Spain concluded that for every subsidised job in renewables that 2.2 jobs were lost elsewhere in the economy. Australia can expect a similar result. So much for proponents claims that there will be an increase in Australian jobs.
[ref: 23/08/20 Report by Dr Moran "The Hidden Cost of Renewables on Electricity Prices"p23]
- Even with significant government subsidies, in its many forms, the PV solar industry has many failures resulting in fewer jobs and incurring A\$millions in losses. Australian company RCR Tomlinson Ltd, an engineering company founded in 1898, collapsed in 2018 after 12 solar IEGW projects failed, leaving **3,400** of its own employees jobless and impacting thousands of subcontracting firms and their workers; creditors were owed **\$630** million. Another Australian company Downers EDI Ltd and a UK company, John Laing, have both withdrawn from the industry in 2020 after losing hundreds \$millions in their ventures into Australian renewables. Many other companies have incurred \$millions each in write-downs in 2019 (e.g. AGL \$14m, QIC \$70m, Enel \$73.5m). So much for an increase Australian jobs, when we already start with at least a deficit of over 3,400 jobs lost.

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[ref: 23/11/18 australianmining.com.au "RCR Tomlinson goes into administration" ; 4/12/18 www.abc.net.au;
reneweconomy.com.au 13/8/20 "AGL joins growing list of investors hit by write-downs on wind and solar assets"]

- The USA has many companies that have failed either building or operating renewable electricity generating works. Over 200 venture capital funded solar energy start-up companies in 2008 had failed by 2013. In addition, many solar IEGW change ownership quite rapidly.

In Australia for example, the \$187million Beryl PV solar IEGW near Gulgong in NSW was built by Downer Group for First Solar FE Holdings Pty Ltd who sold the IEGW, before operations began in June 2019, to New Energy Solar in 2018, who in turn is currently divesting it and exiting the Australian renewables market. Downer has exited the solar construction market and New Energy, an investment company, is divesting its two Australian solar IEGW investments partly because the Australian assets are in a mature operational state. Who received subsidies and who is responsible for decommissioning and disposal at end-of-life when companies fail, change ownership frequently and exit the market?

[ref: greentechmedia.com/articles/read/Rest-in-Peace-The-List-of-Deceased-Solar-Companies; 14/5/18 downergroup.com/downer-wins-beryl-solar-farm-contract; 9/11/20 pv-magazine-australia.com/2020/11/09/beryl-and-manildra-solar-farms-up-for-sale-as-investor-exits-oz/]



Beryl PV Solar Industrial Electricity Generating Works, Central West NSW

4. Are safe

This claim is not supported by the facts, such as:

- A PV solar IEGW being built in Wellington Central West Region currently employs 560 construction workers, "**primarily** made up of **backpackers** hired through contractors". SafeWork NSW has issued 13 improvement notices. Most of the breaches "could easily lead to electrocution of a worker on the project" and "could result in serious injury or death of a worker", most of whom are **backpackers** "who were oblivious to the serious safety risks". So much for safe working conditions for "skilled" workers.

[ref: Daily Telegraph 6/11/20 p15 "Clean energy farm a fatal risk"]

- Solar panels are a toxic mix of gallium arsenide, tellurium, silver, crystalline silicon, lead, cadmium, and heavy earth material. Batteries use lead, lithium and cobalt, all of which are hazardous materials. The magnets in wind turbine generators are made from neodymium and dysprosium, rare earth minerals mined and almost exclusively processed in China, which has covered large tracts of China with fields and lakes of toxic waste. The mining and processing alone of the input materials have already caused human and animal deaths and illnesses, as well as contaminating soil, air and water.

[ref: <https://www.thoughtco.com/lithium-production-2340123>;

[3/4/15 https://www.bbc.com/future/article/20150402-the-worst-place-on-earth](https://www.bbc.com/future/article/20150402-the-worst-place-on-earth); 5/3/18

<https://www.cbsnews.com/news/cobalt-children-mining-democratic-republic-congo-cbs-news-investigation/>;
abcnews.go.com/Technology/toxic-lake-black-sludge-result-mining-create-tech/story?id=30122911]



Toxic "lakes" in Baotou China from processing rare earths

- PV panels contain toxic contaminants, which is why the state of Victoria EPA lists solar panels as e-waste, as does the EU. A national study in the USA found that solar panels dumped into landfill leached toxic materials in as little as 30 days. Solar panels in solar IEGW deteriorate and get damaged by hail, wind and fire and so potentially leaching their toxic chemicals into the soil and waterways. Our governments are knowingly risking the health of Australians, our crops and our domestic animals and wildlife, almost exclusively in rural and regional Australia. Much more research is needed into installed PV solar IEGW dangers.

[ref: www.epa.vic.gov.au/about-epa/news-media-and-updates/news-and-updates/e-waste-compliance-switched-on 3 July 2019; www.ncbi.nlm.nih.gov/pmc/articles/PMC5607867/;

<https://wattsupwiththat.com/2018/12/23/solar-panel-waste-a-disposal-problem/>]



Storm damage to a PV solar IEGW



Fire damage to a PV solar IEGW

- PV solar systems increase fire risks resulting from panel and electrical equipment failures e.g. In June 2019 a bird caused a fire in California Valley Solar Ranch, which burnt out **1,127** acres of grassland causing over **US\$8m** in losses.
[ref: 20/6/19 www.latimes.com/business/la-fi-bird-fire-solar-farm-20190624-story]
- Several fire-fighters from different regions advised SOS members that they can only fight fires in a solar electricity works from its perimeter because of the dangerous high voltages and toxic gases released; this also increases the risks to surrounding properties and land owners who may try to fight an IEGW fire themselves without knowledge of the risks. A risk assessment report prepared in response to requirements raised by the Gunnedah RFS confirms the fire-fighters statements.
[ref: 23/05/18 Mr McCurdy MP (Ovens Valley) (10.19) speech to parliament; 3/8/20 MWRPP decision on Old Mill Rd Gulgong; www.windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/; Eco Logical Australia April 2018. Gunnedah Solar Farm Bushfire Risk Assessment. Prepared for Pitt & Sherry (Operations) Pty Ltd.]
- In addition to fire risks PV solar panels and electrical components pose risks when damaged, such as by hail. The Clean Energy Regulator reported in December 2018 that up to one in five rooftop solar installations (potentially **425,000** systems) pose a high to severe risk because they are unsafe or sub-standard PV installations.
[ref: pvstop.com.au/25-australian-pv-installations-unsafe-1000s-pv-systems-damaged-following-sydney-hail-catastrophe/; solarquotes.com.au/blog/taylor-solar-safety-mb0873/; sunpower.maxeon.com/int/blog/]



Remains of solar panels fire



Solar panels damaged by hail

- Solar panels caused fires on the roofs of as many as seven of Walmart stores in the USA. A solar panel fire in March and two in May 2018 did millions of dollars in damages to the stores and merchandise. All 240 stores had their PV solar systems deactivated pending an investigation. Never-the less, another PV solar fire occurred at the Yuba City Walmart store in November 2018. In the lawsuit filed in August 2019 it is alleged that, among other things, that hotspots on the panels caused some of the fires. Hotspots, which can be caused by bird droppings, dirt deposits, leaf matter, etc, are but 9 common possibilities of how solar system fires can start. Just one fire in a PV solar IEGW could start a devastating fire in a rural area.
[ref: arstechnica.com/tech-policy/2019/08/after-seven-roof-fires-walmart-sues-tesla-over-solar-panel-flaws/; sunengis.com/nine-common-problems-with-solar-panels]

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- Wind turbines contain toxic contaminants, such as neodymium, dysprosium and rare earth minerals. About **1 in 2000** turbines catch fire each year. The burning turbine can release toxic gasses that can drift over residential properties and towns. We need more research. [ref: stopthesethings.com/2020/01/26/toxic-shock-millions-of-wind-turbine-blades-leave-poisoned-landfill-legacy-for-generations-to-come/ ; windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/]



Wind turbine on fire

- Both solar panels and wind turbines can and do catch fire, which can cause significant grass fires and bush fires due to being located in rural and regional areas. For example, the February 2017 Leadville-Dunedoo grass fire burnt 55,000ha of land, destroyed 35 homes and killed 6000 livestock. This area is near Gulgong and within the NSW Government's Central West Renewable Energy Zone. With every wind and solar IEGW built the risks of fire devastation increases. Our governments are knowingly risking the health of Australians, our crops and our domestic animals and local wildlife. [ref: abc.net.au/news/2018-02-08/dunedoo-coronial-inquiry-to-examine-catastrophic-nsw-fire/9408802; windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/]



February 2017 Central West NSW Leadville-Dunedoo fire front



Why we hate grass fires

- Distributing solar and wind IEGW into rural areas, such as Central West NSW, even though the electricity is consumed hundreds of kilometres away in the cities, creates the need for hundreds of kilometres of new transmission lines, which not only impact the environment but increase the incidence of bushfires. In the US, one power company caused **1,500 fires in California** over a period of six years including **the 2018 Camp Fire**, which killed 85 people. [ref: newmatilda.com/2020/01/15/greener-power-comes-with-its-own-increased-risks-of-bushfire/]
- Wind turbines already kill trillions of insects and millions of birds and bats each year, some of them endangered species, such as the American Golden Eagle and Bald Eagle, the European Red Kite, The Hoary Bat, the Australian Wedge-tailed Eagle and migratory Arctic shorebirds. This destruction of wildlife and their habitats can only increase as more solar and wind electricity generating works are constructed where wildlife otherwise flourish in rural areas, including agricultural and grazing land. [ref: [26/6/19 forbes.com/sites/michaelshellenberger/2019/06/26/why-wind-turbines-threaten-endangered-species-with-extinction/#7804852e64b4](https://forbes.com/sites/michaelshellenberger/2019/06/26/why-wind-turbines-threaten-endangered-species-with-extinction/#7804852e64b4); [25/6/19 7news.com.au/news/environment/wind-turbines-killing-endangered-birds-c-183380](https://7news.com.au/news/environment/wind-turbines-killing-endangered-birds-c-183380); thegwpf.com/new-study-german-wind-turbines-kill-1200-tons-of-insects-per-year; discoverwindenergy.com/exploding-wind-turbines-a-look-at-the-max-speed-of-wind-turbines/]



The build up of dead insects reduces the output. Insects attract birds. Blade tip speed can exceed 280kmph

- Documented symptoms reported by individuals exposed to wind turbines sub-sonic includes such things as headaches, sleeplessness and dizziness.
[ref: [science](#), [howstuffworks.com](#) ; [www.ncbl.nih.gov](#)]
- A farming community near Bald Hills Victoria were tormented by wind turbine noise for years. The Supreme Court's decision on 18/08/2020 declared the wind farm an unlawful nuisance.
[ref: [abc.net.au](#) 20/08/20 "Bald Hills Wind Farm neighbours win historic legal battle against turbines 'too close to homes'"]
- A recent study by Caithness Windfarm Information Forum ("Summary of Wind Turbine Accident data to 30 September 2020") of wind industry accidents, including related deaths and injuries identifies hundreds of such events. Wind turbines have started bush fires (e.g. Sibley Iowa, Nolan County Texas), been involved in road accidents (NZ, Princeton Missouri), worker injuries (Germany) and deaths (Washington USA, UK, Denmark, Netherlands).
[ref: 30/0920 <http://www.caithnesswindfarms.co.uk/accidents.pdf>; [gineersnow.com/industries/renewables/two-mechanics-died-wind-turbine-fire](#)]



Road accident involving a wind turbine part



We hope nobody was home

- A fire incident at a turbine can cost up to \$4.5 million, according to a GCube report from 2015, which also stated that, conservatively, one fire a year per 2,000 turbines occurs. Sending a fire-fighting team up the wind turbine tower to manually fight the fire constitutes a significant health and safety risk. If the fire is left to burn, the whole turbine can be damaged beyond repair in a matter of hours and cause bush/grass fires.
[ref: 8/9/20 [windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/](#)]



Burning wind turbines can easily result in starting devastating bushfires or grass fires in rural areas

- Adults and over 40,000 children work in artisanal cobalt mines in The Democratic Republic of Congo in appalling conditions. Many suffer illnesses and death, just to supply China with the cobalt used in the production of lithium batteries, which are then used to back up weather - dependent wind and solar systems. More than 70 percent of the world's **cobalt** is produced in the Democratic Republic of the Congo (**DRC**) and 15 to 30 percent of the Congolese **cobalt** is produced by artisanal and small-scale **mining**. Should Australians ignore this human rights abuse to satisfy some peoples' ideological dogma?

[ref: 11/11/14 nationalgeographic.com/news/energy/2014/11/141111-solar-panel-manufacturing-sustainability-ranking/ ; <https://doi.org/10.1016/j.gloenvcha.2019.102028> "The decarbonisation divide: contextualising landscapes of low-carbon exploitation and toxicity in Africa"; www.cfr.org/blog/why-cobalt-mining-drc-needs-urgent-attention; <https://www.theguardian.com/global-development/commentisfree/2019/dec/16/i-saw-the-unbearable-grief-inflicted-on-families-by-cobalt-mining-i-pray-for-change>]



Democratic Republic of Congo: E.g. of artisanal mining of cobalt, used in batteries, destroys many African lives

5. Are good for the environment

This claim is not supported by the facts, because of the huge amounts of land, materials and transport required as well as the destruction of habitat and killing of wildlife, such as:

- The **land area needed** for an **industrial PV solar plant** per installed (name plate) 1,000MW or **one gigawatt (GW)** is **3,500 hectares (ha)**. The **materials needed** on average are: 22,000t (tons) aluminium, 40t cadmium, 60,000t concrete, 2,000t copper, 3.5t gallium, 2t germanium, 13t glass, 20t indium, 3,250t plastic, 6,500t silicon, 0.3t silver, 75,000t steel and 46.7t tellurium for a **total of 169,363t**. For a **nuclear reactor the total is 259ha of land and 217,101t of materials per 1GW** installed capacity.

However, a **nuclear reactor annual output is over 90% whereas PV panels are, at best, initially under 30%**. Hence, the **PV solar** installed nameplate **needs to be at least three times greater** to produce the same, albeit intermittent, output (GWh) yearly i.e. **10,500ha** (3,500ha x 3) of land and **total materials of 508,089** (169,363t x 3) tons, which is **40.5 times more land and 2.3 times more tons of materials than a 1GW nuclear plant**.

The negative impacts on the environment of the significant increase needed in mining, processing, transport, construction, reduction in productive land, etc. is very substantial for PV solar plants and should not be ignored.

[ref: Average hectares based on developers' published figures for Beryl, Gulgong, Stubbo and Wellington solar works; materials from sciencedirect.com "global environmental change Vol 60 Article 102028 table 1"]

- The **land area needed** for a **modern wind turbine IEGW** per installed (nameplate) 1,000MW or **one gigawatt** is **25,900 hectares**. Materials needed are: 305,891t concrete, 211t copper, 19,863t fibreglass, and 84,565t steel for a **total of 410,530t**. For a **nuclear reactor the total is 259ha of land and 217,101t of materials per 1GW**.

However, a nuclear reactor annual output is over **90%** whereas wind turbines are, at best, initially under **40%**. Hence, the wind turbine installed nameplate needs to be **2.25 times greater** to produce the same, albeit intermittent, output (MWh) yearly i.e. **58,275ha** of land and **total materials of 923,693 tons** per 1,000MW, which is **225 times more land and 4.3 times more materials than a 1,000MW (1GW) nuclear plant**.

The negative impacts on the environment of the very significant increase needed in mining, processing, transport, construction, land clearing, etc. is very, very substantial for wind IEGW and should not be ignored.

[ref: Average hectares based on developer's published figures for Coopers Gap wind turbine works; materials from sciencedirect.com "global environmental change Vol 60 Article 102028 table 1"]

- **Liddell Power Station** is a **2,000MW** nameplate capacity coal fired power station. Using the previous land/materials for nuclear and solar installations to replace Liddell's nameplate generation capacity of **2,000MW**, and an assumed **90%** output annually of a similar modern replacement plant, will require: **Solar - 21,000ha of land, 1,016,178 tons of materials; Wind - 116,550ha of land (equals about 137 Sydney airports), 1,847,386 tons of materials; Nuclear - 518ha of land, 434,202 tons of materials**. A very substantial difference on their impacts on the world's environment and resources. The impact globally on the environment should not be ignored.

Although beyond the scope of this paper, the solar and wind land and material requirements will be much larger to account for frequent life-cycle replacement/upgrades

and efficiency losses as well as the required backup/duplicated power sources. Not only is nuclear power (and closed cycle gas-turbine power for that matter) much less demanding on resources and can operate without alternative backup for over 70 years it also has much less impact on the environment (e.g. less mining, less reduction of animal habitats, much less volume of toxic waste).

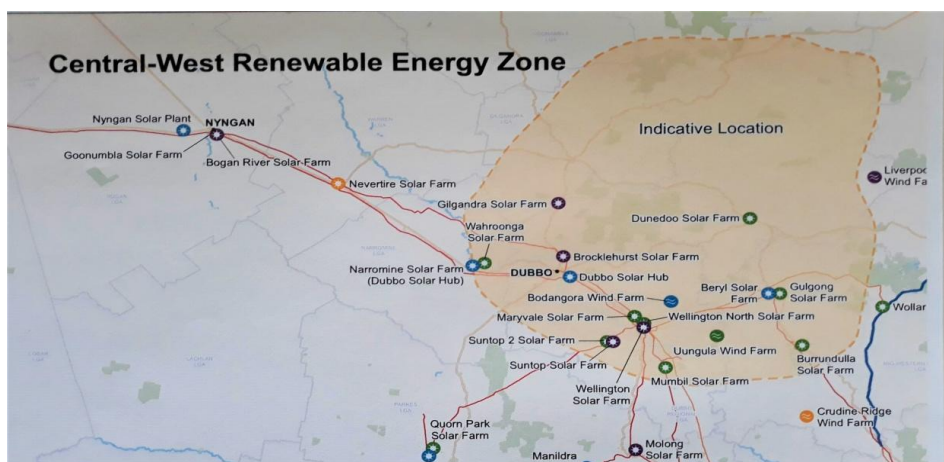
[ref: www.energy.gov "What's the lifespan for a nuclear reactor" lifespan could be 80 years; 29/6/17 technocracy.news/solar-energy-produces-300-times-toxic-waste-nuclear-power/]

- The NSW Government in November 2019 declared the Central-West a Renewable Energy Zone (C-W REZ), which will be a 3,000MW (3GW) pilot for two other Renewable Energy Zones. What this means for the Central West, which already has several weather-dependent IEGW in operation or under construction, is even more environmental destruction. Just for the stated small increase of 3,000MW nameplate capacity (potential output of 26,280GWhpa), excluding any backup/duplication power and new transmission lines, etc, of:
Nuclear plant only, assuming a 90% capacity factor (i.e. 3 x24 x365 x 0.9GWh), would require only: land **777ha** (less than one Sydney airport in size); materials **651,303 tons**.
Solar plants only, assuming a 30% capacity factor, would require: **31,500ha** of fully high-fenced farm land (size of 37 Sydney airports) and over **1,524,267 tons** of materials;
Wind plants only, assuming 40% capacity factor, would require **174,285ha** of farm and mountain top land (size of 207 Sydney airports) and over **2,771,079 tons** of materials.

Even putting aside all the pre and post negative impacts on the Australian and overseas environments of weather-dependent installations, the massive loss of local wildlife habitat, high increased risk of grass and bushfires destroying more habits and farmland, leaching of toxic substances into soil and waterways, loss of farmland for food production, visual pollution for all local people and visitors for 25 to 30 years minimum, increased water use, ever higher electricity bills, ongoing subsidies to developers, more transmission lines scarring our lands and the risk that some of these industrial installations will remain in-situ after their end-of-life as many of the developers and land owners will no longer exist, is a high price to pay for no gain.

Why do rural and regional citizens have to bear the burden and known risks of weather-dependent renewables, which are driven by ill-informed, ideologically obsessed politicians?

[ref: <https://energy.nsw.gov.au/media/1921/> " NSW Electricity Strategy"; Average hectares based on developers' published figures for Beryl, Gulgong, Stubbo and Wellington solar works; materials from sciencedirect.com "global environmental change Vol 60 Article 102028 table 1"; Average hectares based on developer's published figures for Coopers Gap wind turbine works]



NSW C-W REZ

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A research paper prepared by SOS Central West NSW November 2020

- The National Electricity Market participants (QLD, NSW, VIC, SA, TAS) generated from coal and gas plants **151,900GWh** out of a total of **192,400GWh** in 2019/20. For just PV Solar IEGW or just Wind IEGW to replace this output would require at least **2,187km²** or **11,393km²** respectively of land taken out of other use and excludes the necessary backup/duplication sources (hydro, batteries and roof-top solar) and new transmission lines. Using the 2019/20 mix of industrial solar (28%) and wind (72%) generation, the land mass would be **8,815km²** or **71%** of the size Greater Sydney (bounded by Gosford/Wyong, RNP and Blue Mountains), which is 12,368km², or more than 58 times the size of The Royal National Park (151km²).

The fencing of this land for solar and wind IEGW will destroy wildlife corridors, nesting and feeding habitats for decades and possibly destroy whole ecosystems.

[ref: solar 1.44ha/GWh, wind 7.5ha/GWh based on developers' published figures; <https://aemo.com.au/-/media/Files/Electricity/NEM/National-Electricity-Market-Fact-Sheet.pdf> 28/07/20; April 2020 www.cityofsydney.nsw.gov.au/guides/city-at-a-glance]

- Visually polluting the land can detract from the natural beauty of the vistas, which in turn can deter tourists from visiting some small towns and surroundings in rural regions of Australia. Domestic and overseas tourists and life-style change people expect to see the best that rural areas have to offer, not thousands of km² of weather-dependent wind and solar industrial complexes.

[ref: 3/8/20 MWRPP decision on Old Mill Rd Gulgong DA0283/2019]



Country scene



Now an Industrial scene

- The proposed **\$1 billion** Star Hotel Project development in Pyrmont Sydney involves a 254 rooms in a building of about **100 metres** tall to be viable. At this stage approval is unlikely for the hotel because of government imposed height restrictions. Sydney's tallest building is **305m** high plus a **4m** lightening rod.

However, in our rural regions and near regional towns we are expected to support hundreds of wind turbines that, even today can be **270m tall** and getting larger each year. These wind turbines take up thousands of hectares of agricultural land or bushland hill tops, require dirt roads to be built that will erode the landscape. Such numerous and massive structures with very large fast moving blades are not just visual pollution but pose real dangers to wild-life and their habitats, people and property.

[ref: robbinsislandwindfarm.com/projects; Bing search- pics of wind turbines; The Daily Telegraph page 14 4/11/20; 8/9/20 windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/]



Will our regions be dominated by multitudes of 270m wind turbines? Sydney Tower at 309m dominates CBD

- Nature Communications published on 1/9/2020 a science paper on world-wide mining and its impact on the environment, which stated that: *"Most mining areas (82%) target materials needed for renewable energy production, .."* and so *"Mining threats to biodiversity will increase as more mines target materials for renewable energy production..."*. *"The authors discovered that a greater proportion of pre-operational mines are targeting materials needed for renewable energy production (nearly 84%) compared to around 73% of operational mines"*.

All this additional mining just for renewables is environmental vandalism.

[ref: nature communications "renewable energy production will exacerbate mining threats to biodiversity"]

- Pre-construction pollution of the environment, both within and outside of Australia, is significant for solar installations. Apart from mining ores (coal, bauxite, copper, limestone, aggregate, silver, iron ore, etc.) used in producing construction materials (steel, aluminium, concrete) PV solar panels also need cadmium, germanium, gallium, indium, tellurium, silica, quartz, and plastics (made from cellulose, coal, oil, natural gas). Lithium batteries need rare earths, metals, plastics, cobalt and lithium. Extraction, purifying, and processing many of these inputs results in significant toxic waste, e.g. **producing one ton of rare earth elements releases up to 420,000 cubic feet (11,893m³) of toxic gases, 2,600 cubic feet (73.6m³) of acidic wastewater, and one ton (0.91 tonnes) of radioactive waste.**

[ref: Plasticseurope.org "How plastics are made"; Sovacool 2010; thoughtco.com/rare-earth-metals-2340169; mineralseducationcoalition.org/mining-minerals-information/minerals-in-your-life/ Fact sheet "solar panels"; 16/4/20 heartland.org/_template-assets/documents/publications/PBdriessenmining2Apr20.pdf; samcotech.com/what-is-lithium-extraction-and-how-does-it-work/]



Extraction of lithium pumped from underground salar brine deposits into evaporation ponds

- Crystalline silicon is a key component of many solar panels. The production of crystalline silicon involves a by-product called silicon tetrachloride, which is highly toxic, killing plants and animals. Such environmental pollutants, which harm people, are a major problem for people in China and other countries. Those countries mass-produce "clean energy" solar panels but do not regulate how toxic waste is dumped into the

environment. The country's inhabitants often pay the price. Australians should not ignore what happens to people overseas so that we can feel good about having "green energy".

[ref: 30/4/18 sciencing.com/effects-chlorofluorocarbons-humans-7053.html]

- Pre-construction pollution of the environment, both within and outside of Australia, is significant for wind turbine installations. Apart from mining ores (coal, bauxite, copper, limestone, aggregate, clay, gypsum, iron ore, etc.) used in producing construction materials (steel, aluminium, concrete) wind turbines also need rare earths (neodymium, dysprosium), cobalt and fibreglass/carbon fibre (made from oil).

Extraction, purifying, and processing many of these inputs results in significant toxic waste, e.g. producing one ton of rare earth elements releases up to 420,000 cubic feet of toxic gases, 2,600 cubic feet of acidic wastewater, and one ton of radioactive waste. According to the Bulletin of Atomic Sciences, a 2 megawatt (MW) wind turbine contains about 800 pounds (363kg) of neodymium and 130 pounds (59kg) of dysprosium. For each **ton of carbon fibre**, which is used for wind turbine blades, there is 10 tons (9.1 tonnes) of **CO2 emitted**. A **100m** carbon fibre blade weighs **40 tonnes**. Three blades per modern turbine therefore weigh **120 Tonnes** and these alone cause emissions of **1,088Tonnes of CO2**.

[ref: bbc.com/bbcnews "What happens to all the old wind turbines?" 7/2/20;

mineralseducationcoalition.org/mining-minerals-information/minerals-in-your-life/ Fact sheet "wind turbines";

31/3/20 compositesworld.com/articles/wind-turbine-blades-glass-vs-carbon-fiber/; July 2020 manhattan-institute.org/mines-minerals-and-green-energy-reality-check]

- Both solar and wind electricity generation require several rare earth minerals. The yield per ton of ore ranges from a few grams to less than a gram depending on the rare earth involved. Extracting rare earths involves the use of toxic chemicals (sulphuric acid, alkali, nitric acid) and creates toxic waste (dust concentrate, sulphur dioxide, hydrofluoric acid) including radioactive waste. China processes the majority of rare earths. Processing of rare earths results in toxic lakes, such as Baotou Lake in Mongolia, China.

[ref: 3/4/15 bbc.com/future/article/20150402 "The worst place on earth"; 11/4/15

digitaljournal.com/news/environment/baotou-a-toxic-lake-created-because-of-a-thirst-for-technology/article/430511; chinapower.csis.org/china-rare-earth/]



Processing rare earths in China



Rare earths toxic waste containment

- Pollution of the environment, both within and outside of Australia, is significant for solar installations during and post decommissioning. The toxic chemicals in solar panels include cadmium telluride, copper indium selenide, cadmium gallium (di)selenide, copper indium gallium (di)selenide, hexafluoroethane, lead, and polyvinyl fluoride. Additionally, silicon tetrachloride, a by-product of producing crystalline silicon, is highly toxic. Backup lithium batteries contain toxic lead, cobalt and lithium.

[ref: 30/4/18 sciencing.com/effects-chlorofluorocarbons-humans-7053.html; 5/3/18

<https://www.cbsnews.com/news/cobalt-children-mining-democratic-republic-congo-cbs-news-investigation/>;

www.sustainability.vic.gov.au "The growing issue of PV system waste]

- Pollution of the environment , both within and outside of Australia, is significant for wind turbine installations during and post decommissioning.
[ref: stopthesethings.com/2015/04/25/wind-powers-toxic-embrace/; bloomberg.com/news/features/2020-02-05/wind-turbine-blades-can-t-be-recycled-so-they-re-piling-up-in-landfills]
- Wind turbine blades made from fibreglass or carbon fibre are being buried because they are too difficult to economically recycle. Carbon fibre is not biodegradable and will last indefinitely. Germany has over 5,900 wind turbines due for decommissioning in 2021 and therefore 11,800 blades to dispose of soon. In Tennessee USA, 1,000 end-of-life turbine blades were buried near a river.
[ref: CFtechnewsworld.com "The Perplexing Carbon Fiber Repurposing Problem"; bloomberg.com/news/features/2020-02-05/wind-turbine-blades-can-t-be-recycled-so-they-re-piling-up-in-landfills]



Disposing of cut up wind turbine blades



- Photovoltaic manufacturers use a lot of water for various purposes, including cooling, chemical processing, and air-pollution control. The biggest water waster, though, is dust control and cleaning panels during installation and use. Utility-scale PV solar projects in the 230 to 550 megawatt range can require up to **1.5 billion litres of water** for dust control during construction and another **26 million litres annually** for panel washing during operation. An installed **400MW** PV solar IEGW has about **900,000** panels, which should be washed whenever dust accumulates as dust can reduce efficiency by up to 10% and other contaminants up to 30%. Water is precious in the rural areas of Australia where nearly all these IEGW have been or are being built, or are proposed to be built.
[ref: spectrum.ieee.org/green-tech/solar/solar-energy-isnt-always-as-green-as-you-think; pveducation.org/pvcdrom/modules-and-arrays/degradation-and-failure-modes]



Construction site dust control



Cleaning PV solar panels

- The Kathleen Valley WA lithium project needs to mine **139 million tonnes of ore to get 1.8 tonnes of lithium (1.3% yield)**. The extraction and processing of lithium requires considerable heat and the by-products, such as chlorine gas, can contaminate the soil, air and water. More extensive mining and all the habitat destruction, polluting activities and transport will grow and grow as more batteries for renewables backup and electric cars expands.

For example, a Tesla utility scale power pack weighs **2199kg** and contains about **45kg** of lithium, which equates to mining **3,475,000 tonnes of ore per power pack**.

The Hornsdale Power Reserve in South Australia uses over **150** Tesla Power Packs.

Compared with a natural gas power plant, the total mining required for solar, wind and their backup is at least **10** times as many total tons mined, moved, and converted to deliver the same quantity of energy. The expanding environmental impacts of all this additional mining and processing should not be discarded by our governments.

[ref: [thoughtco.com 21/8/20 "An overview of commercial lithium production"](https://thoughtco.com/2018/08/20/an-overview-of-commercial-lithium-production/); [salon.com 17/6/19 "Electric cars are still better for the environment"](https://salon.com/2017/06/19/electric-cars-are-still-better-for-the-environment/); [www.boardroom.media 20/02/20 ASX:LTR Liontown's victory"](https://www.boardroom.media/2020/02/20/asx-ltr-liontowns-victory/); manhattan-institute.org/mines-minerals-and-green-energy-reality-check; tesla.com/powerpack; electrek.co/2016/11/01/breakdown-raw-materials-tesla-batteries-possible-bottleneck/]



Open cut lithium mines

- The **7,500** hectare Hornsdale Windfarm in SA has a capacity of **316MW** and a claimed capacity factor of **37.9%** (1,050GWh annually). When the wind turbines are becalmed, sometimes for days, then no electricity is produced. Advocates for renewables claim battery backup (they oppose coal, natural gas and nuclear electricity generation) can fill this void.

On average, wind IEGW in Australia do not produce electricity for three days of each week. How much would the Hornsdale Power Reserve batteries (currently **150MW/193.5MWh** in size) need to be expanded to supply the backup electricity needed for, say, 72 hours before being exhausted? A staggering increase of **118** times as large (316MW x 72h /193.5MWh). The Hornsdale Power Reserve cost about **\$130m** (stage 1 was \$90M plus annual fees of \$4m+), required 1ha of concrete slabs, and 4.3T of batteries and inverters). Scaled up 118 times comes to **\$1.534 billion cost, 118ha of concrete slab and 504 Tonnes of battery equipment**.

Compare this with AGL's proposed **250MW** capacity, **90%** (1,971GWh) capacity factor, dual fuel closed cycle gas turbine with carbon capture plant (CCGT-CC) on only **91ha** at a cost of only **\$400m** and expected life of **25 years**.

The extent of mining (10 times more than an equivalent capacity natural gas power plant) of lithium, cobalt, nickel, graphite, etc. is staggering, especially when the output of Hornsdale only represents less than 0.5% of Australia's 2019-20 electricity consumption (NEM **192,400GW** plus WA & NT add 10% more). A similar calculation for solar IEGW would be

30% worse due to their much lower capacity factors.

In addition, one can calculate that one annual gigafactory production of 50GWh of Tesla batteries would be enough to provide back-up for 6min for the entire US power consumption (and then no Teslas to drive). Today's battery technology cannot be the solution to renewables intermittency.

How can consuming so much extra of the Earth's resources ever be justified, especially as replacement of weather-dependent renewables is necessary every one, two or three decades?

[ref: hornsdailewindfarm.com.au; The Daily Telegraph p5 21/10/20 "Kean backs kids opposed to govt's gas strategy"; <http://joannenova.com.au/2020/08/wind-power-failure-100-times-a-year-we-get-a-500mw-outage> ; hornsdailepowerreserve.com.au; abc.net.au/news/2018-09-27/tesla-battery-cost-revealed-two-years-after-blackout/10310680; tesla.com/powerpack; gizmodo.com.au/2017/07/all-the-details-on-teslas-giant-australian-battery/; power-technology.com/projects/newcastle-power-station-new-south-wales-nsw/; electrek.co/2016/11/01/breakdown-raw-materials-tesla-batteries-possible-bottleneck/; Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"; AER: AEMO, data 9/10/20]



Hornsdaile Power Reserve (batteries) and Wind IEGW, South Australia

- Apparently, many advocates of weather-dependent renewables regard CO2 emitting biomass power stations that burn wood as a better backup/base load power source than coal, gas or nuclear and better for the environment. The ARD's "Das Erste" reports how satellite images show deforestation has risen **49%** since 2016 in Sweden, Finland, and the Baltic countries, for use in biomass electricity plants.

Also, the EU import wood chips/pellets from North American and Chilean forests for burning in biomass plants, which involves lots of fossil fuel used in harvesting, drying, pelletising, and transport by road and ship. Also, large losses of habitat for wildlife. A harvested forest replacement can take **100** years to reach to the same level of stored carbon that existed prior to harvesting. Biomass plants result in an additional, instantaneous CO2 release into the atmosphere of about **3.6** times that produced by burning Natural Gas for the same power output. Biofuels also destroy whole ecosystems.

At least some well known environmentalist are speaking out against Biomass and Biofuel plants, stating that they are unsustainable and environmentally damaging methods of producing electricity.

[ref: 6/9/20 notrickszone.com/2020/09/06/environmental-disaster-northern-europe-deforestation-up-49-due-to-effort-to-meet-co2-targets/; 30/06/18 theguardian.com/environment/2018/jun/30/wood-pellets-biomass-environmental-impact 20/11/18; <https://www.nytimes.com/2018/11/20/magazine/palm-oil-borneo-climate-catastrophe.html>; 11/11/20 'The contradictions of Green policies to limit CO2 emissions'; Environmentalist M Moore and M Shellenberger]

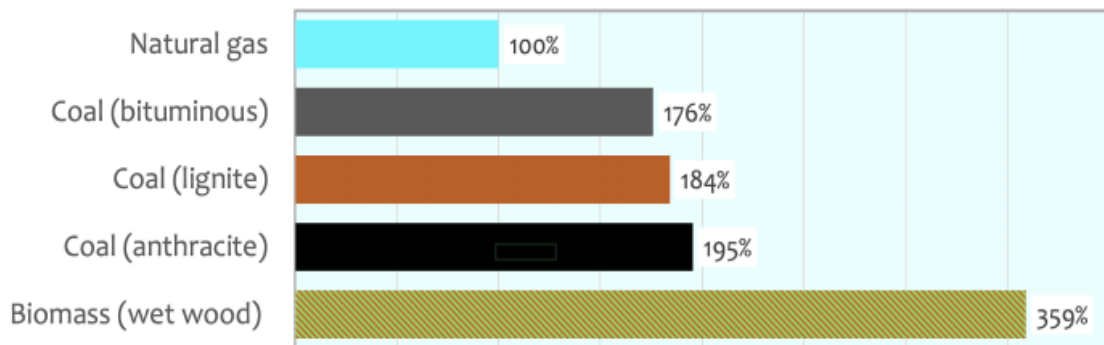


Biomass power plant



Biomass fuel

Comparing estimated CO2 emissions output for power generation fuels



Graph from 11/11/20 'The contradictions of Green policies to limit CO2 emissions'

- *"Solar panels create 300 times more toxic waste per unit of energy than do nuclear power plants. If solar and nuclear produce the same amount of electricity over the next 25 years that nuclear produced in 2016, and the wastes are stacked on football fields, the nuclear waste would reach the height of the Leaning Tower of Pisa (53 meters), while the solar waste would reach the height of two Mt. Everests (16 km)."*
[ref: quote from <https://wattsupwiththat.com/2018/12/23/solar-panel-waste-a-disposal-problem/>; Jemin Desai and Mark Nelson, "Are we headed for a solar waste crisis?", Environmental Progress, June 21, 2017]
- *"Contrary to previous assumptions, pollutants such as lead or carcinogenic cadmium can be almost completely washed out of the fragments of solar modules over a period of several months by rain water."*
[ref: quote from <https://wattsupwiththat.com/2018/12/23/solar-panel-waste-a-disposal-problem/>; Michael Shellenberger, "If solar panels are so clean, why do they produce so much toxic waste?", Forbes, May 23, 2018]
- C Millis, a USA Carolina state representative was the lead sponsor of House Bill 745, which required proper decommissioning of utility-scale solar plants after they close, reclamation of the land to its original condition within two years, and posting financial guarantees to ensure the work gets done. The article raised the concern that not enough research has gone into the decontamination impacts of solar plants on the soil. One study concluded that after land restoration peanuts could no longer be grown because of the high zinc concentrations in the soil that leached from solar panels.

In Central West NSW alone we have several solar plants in place or proposed with capacities ranging from 11MW to 400MW where the potential contamination to the soil, surface and underground water supplies are very high. Planning submissions from developers must include independent research on the risks and, if still approved, ongoing monitoring and reporting of soil and water condition on and around the site must be done. Also, fully funded

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decommissioning, site restoration and disposal plans must be lodged with the submissions.

[ref: carolinajournal.com/news-article/environmental-hazard/ "Moore County residents worry about solar's long-term environmental impacts - Carolina Journal"]

6. Are clean sources of energy

This claim is not supported by the facts or actual experience, largely because the toxic waste occurs both inside and mainly outside of Australia, such as:

- The PV cell manufacturing process includes a number of hazardous materials, most of which are used to clean and purify the semiconductor surface. These chemicals include hydrochloric acid, sulphuric acid, nitric acid, hydrogen fluoride, 1,1,1-trichloroethane, and acetone. The amount and type of chemicals used depends on the type of cell, the amount of cleaning that is needed, and the size of silicon wafer .
[ref: <https://www.ucsusa.org/resources/environmental-impacts-solar-power>]
- Weather-dependent solar and wind electricity generation, including the use of lithium batteries for partial backup, involve mining and extraction processes that generate huge amounts of toxic waste, especially in China and The Democratic Republic of Congo. Solar panels contain a toxic mix of gallium arsenide, tellurium, silver, crystalline silicon, lead, cadmium, and heavy earth materials. Batteries use lithium and cobalt, both of which are hazardous materials. The magnets in wind turbine generators are made from neodymium and dysprosium, rare earth minerals mined and processed almost exclusively in China and which has covered large tracts of China with fields and lakes of toxic waste.
[ref: <https://www.thoughtco.com/lithium-production-2340123>; 3/4/15 <https://www.bbc.com/future/article/20150402-the-worst-place-on-earth>; 5/3/18 <https://www.cbsnews.com/news/cobalt-children-mining-democratic-republic-congo-cbs-news-investigation/>]
- The Victorian government has declared all solar panels as e-waste, as has the EU; their disposal cannot go to land-fill because of the toxic materials in each panel. EPA Regulatory Programs Director Rachel Gualano said '*officers would be inspecting sites with a focus on preventing harm to the environment and human health, including land and groundwater contamination, stockpiling and mitigating fires*'. Panels are unsuitable for burying in landfill but our governments think covering thousands of hectares of rural land with solar panels is alright.
[ref: www.sustainability.vic.gov.au "The growing issue of PV system waste"; www.epa.vic.gov.au/about-epa/news-media-and-updates/news-and-updates/e-waste-compliance-switched-on 3 July 2019]
- Victoria's government has stated that: "*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"]
- Globally, the toxic waste already produced from mining for and processing of rare earths metals, cobalt, silver, lithium, etc. for use in wind and solar systems, including backup batteries, is causing pollution of land and soil, serious health conditions in residents, workers, animals and crops and the exploitation of children in cobalt mines.
[ref: 11/11/14 nationalgeographic.com/news/energy/2014/11/141111-solar-panel-manufacturing-sustainability-ranking/ ; <https://doi.org/10.1016/j.gloenvcha.2019.102028> "The decarbonisation divide: contextualising landscapes of low-carbon exploitation and toxicity in Africa"]

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- As wind and solar systems reach their end-of-life, the decommissioning, recycling and disposal are creating more toxic waste. It is estimated that the waste from just solar panels will grow from **0.25 million tonnes** in 2016 to **78 million tonnes** by 2050. At present most of these toxic panels go to landfill or storage.

[ref: www.sustainability.vic.gov.au "The growing issue of PV system waste";

<https://www.irena.org/publications/2016/Jun/End-of-life-management-Solar-Photovoltaic-Panels>]

- The main environmental problems linked with photovoltaic panels, if not properly disposed of are: leaching of lead; leaching of cadmium; loss of conventional resources (primarily aluminium and glass) and; loss of rare metals (silver, indium, gallium, cadmium and germanium). Studies have shown that rain can leach toxic materials from solar panels over time in-situ due to deterioration or within 30 days if disposal is in land-fill. Recycling solar panels is not currently economic and is becoming less so as the silver content is reduced, so more and more panels will go to land-fill, whether locally or sent to developing countries.

[ref: [ec.europa.eu/environment/waste/weee/pdf/Study on PVs Bio final.pdf](http://ec.europa.eu/environment/waste/weee/pdf/Study_on_PVs_Bio_final.pdf); 15/0/15 www.ncbi.nlm.nih.gov "Leaching of cadmium and tellurium from cadmium telluride (CdTe) in thin-film solar panels under simulated landfill conditions"]

- Wind turbine blades are made of toxic composite materials, such as fiberglass, epoxy, polyvinyl chloride foam, polyethylene terephthalate foam, balsa wood, and polyurethane coatings. These blades cannot be economically recycled and are being incinerated in the EU countries or buried in other countries. The plastics in the blades are highly toxic, and contain Bisphenol A, which is so dangerous to health that the European Union and Canada have banned it.

[ref: stopthesethings.com/2020/01/26/toxic-shock-millions-of-wind-turbine-blades-leave-poisoned-landfill-legacy-for-generations-to-come/]



Cutting up end-of-life wind turbine blades



Disposing of cutup wind turbine blades

- Fire-fighters have to take special precautions when fighting a fire in a PV solar electricity generating works because of the dangerous voltages and the release of toxic fumes from burning panels and cables. Their approach is to just contain the perimeter of a solar IEGW.

[ref: [submission on DA0283/2019 to MWRPP 3 August 2020; 23/05/18 Mr McCurdy MP \(Ovens Valley\) \(10.19\) speech to parliament; \[www.windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/\]\(http://www.windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/\)\]](#)



PV solar IEGW left to burn out



PV solar panel fire

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- Fossil fuels are regarded by renewables advocates as not being clean energy. Then weather-dependent renewables and their required backup (batteries and biomass plants) cannot be clean either as coal and oil are extensively used throughout the life-cycle of these weather-dependent renewables. For example: for mining and processing materials; to make steel and plastics; for lubrication; for use in transporting components; for clearing land; for decommissioning and; for disposal.
- The use of biomass (burning wood and vegetation) power plants as a backup to weather dependent wind and solar electricity generation when they are not producing sufficient/any electricity is being recognised by prominent environmentalists as adding more CO₂ and airborne particulates than burning coal because wood has a lower energy density than all other fuels.

[ref: Michael Moore documentary "Planet of the Humans" 21/4/20 Youtube; 30/6/20 Michael Shellenberger "Apocalypse Never" p192 - 193]



Biomass energy plant - trees to woodchips to fuel



Biomass energy from wood chips by the truck load

- According to an article in Nature.com the lead from perovskite, used in the next generation of solar cells, leaking into the ground can enter plants, and consequently the food cycle, ten times more effectively than other lead contaminants already present as the result of the human activities. All solar panels contain some degree of contaminates yet the developers do not disclose these risks and in some cases do not even specify what type of solar panels they will install. We must be given this information at the EIS stage. Our environment and health are at risk.

[ref: 21/01/20 [nature.com/articles/s41467-019-13910-y](https://www.nature.com/articles/s41467-019-13910-y)]

7. Will eliminate fossil fuel use

This claim is not supported by the facts, such as:

- Mining for metals and minerals required for renewables is targeting **82%** of all mining on Earth. With increased mining comes increased use of fossil fuels to manufacture equipments, undertake mining, transport and process ore, etc, etc, etc.
[ref: [Nature Communications "renewable energy production will exacerbate mining threats to biodiversity"](#)]
- Fly ash is a useful by-product of burning coal in coal fired power plants. It has several uses but a very important use is in making concrete, either Portland or Geopolymer, for use in building dams and wind turbine footings. Fly ash use in concrete reduces the amount of cement required, which reduces the cost of concrete and also reduces CO2 emissions.
[ref: [cementaustralia.com.au/products/fly-ash](#); [gharpedia.com/blog/fly-ash-for-concrete-uses-advantages-and-disadvantages](#)]
- Transport, much of it specialised for wind turbines, requires tyres, lubricants, diesel fuel, plastics to name a few examples essential to the construction of wind and solar IEGW. In 2011, moving just one complete turbine took 9 to 10 trucks, most of which were specialized trailers. Different trailers are needed for the nacelle, blades, and towers. In 2020 wind turbines are significantly bigger and heavier. Ports and ships also have to be modified to handle such sizes and weights. All these equipments depend on fossil fuels for their construction and operation.
[ref: [windpowerengineering.com/challenges-in-moving-huge-and-heavy-components/](#)]



Unloading a wind turbine blade from a ship



One wind turbine blade being taken to its site

- Steel manufacture needs coke (solid carbon and some ash) derived from heating metallurgical coal at 1000 degrees Celsius. The coke is added to iron ore in a 2,000 degrees Celsius flame blast furnace. The furnace heat is created from either oil or natural gas combined with oxygen. It takes around **770 kilograms** of coal to make **one ton** of steel. Steel is essential in all stages of weather-dependent renewables from mining, processing, transport, manufacture, construction, decommissioning and disposal. Hence, coal remains essential to creating wind and solar IEGW.
[ref: [bhp.com/our-businesses/our-commodities/metallurgical-coal/](#); Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"]
- *"Plastics are derived from natural, organic materials such as cellulose, coal, natural gas, salt and, of course, crude oil"* and are heavily used in solar panels and wind turbine systems, including lithium batteries. Fossil fuels would have to remain in use for many decades.
[ref: [plasticseurope.org " How plastics are made"](#); [sciencedirect.com](#)]

8. Have strong community support

This claim is not supported by the facts, such as:

- The May 2019 Australian Federal election was billed as a referendum on addressing climate change through the aggressive transition to renewables. The majority of voters rejected this proposition at the ballot box. Our elected governments should abide by the majority decision made by the Australian people.
- The NSW mid-west historic town of Gulgong is one of many rural and regional towns around Australia that oppose the locating of wind and PV solar electricity generating works close to their towns. They already have the 310ha Beryl IEGW only 5km from town. The historic rural town of **2500** people lodged **435** objections against a DA for another solar electricity generating works only 600m from Gulgong township. Ultimately they achieved a unanimous decision by the Mid-Western Regional Planning Panel (MWRPP) on 3/8/2020 to not approve the development application for a PV electricity generating works at Old Mill Road.
[ref: 3/8/20 MWRPP decision; soundcloud.com/user-645092504/western-regional-planning-panel-ppswes-1-mid-western-3-august-2020 6/8/20 www.mudgeeguardian.com.au/story/6867372/solar-farm-at-old-mill-road-in-gulgong-will-not-go-ahead/?cs=12]
- There many community groups that oppose weather-dependent renewables, especially those in country and regional Australia where residents have to live with the consequences of ill-conceived and ruinous government policies. Examples, just in the Central West region of NSW, include: 28/6/19 "Residents and business leaders opposed to the location of the proposed Burrundulla Mini Sustainable Energy Park, met in Mudgee on Friday to voice their concerns." (Over 1000 objections were lodged); "16/9/2020 · Local News RURAL ANGER: Farmer Rob Green is upset about plans for 12,180 solar panels to be built in 140 rows on this land next to his property."; "26/11/2018 · Local residents, farmers in the Suntop district southwest of Wellington, are gathering to oppose the installation of a giant solar farm covering one-and-a-half times the area of Wellington itself."
[ref: theland.com.au/story/6254162/hugely-visible-and-too-close-issues-raised-over-proposed-solar-farm/; centralwesterndaily.com.au/story/6925887/farmer-fights-12000-panel-solar-farm-blight-planned-for-the-property-next-door/; theland.com.au/story/5768400/suntop-residents-heated-over-proposed-second-solar-farm/]
- EPYC withdraws application to develop **54** turbine wind farm 5km from Tarago NSW, after two planning department rejections and **400** plus **community** objections.
[ref: reneweconomy.com.au "Jupiter wind farm plans abandoned in face of community objections"; abc.net.au/news/2018-03-18/controversial-wind-farm-application-withdrawn/9560698]
- "Nundle, a small town in NSW is pleading with Sydneysiders to join them in a fight against a \$600 million wind farm. The historic village of Nundle, in the New England region, is fighting against a proposal to build 98 wind turbines, spanning 20km between Nundle and Hanging Rock".
"A picturesque little village of 300 people near Tamworth, Nundle is about to be transformed by a wind farm on its doorstep. Within a few kilometres of this tourist town, and visible to almost everyone in the district, there's a proposed \$600 million wind farm with nearly eighty 220m high turbines stretching over 20 kilometres of ridge line." What they're trying to do here is force it on a community that doesn't want it".
Why are our governments not listening? Why are they destroying our surroundings?
[ref: 1/7/20 2gb.com we-need-your-help-small-towns-impassioned-plea-to-sydneysiders/; 4/7/20 dailytelegraph.com.au/news/ Peta Credlin]

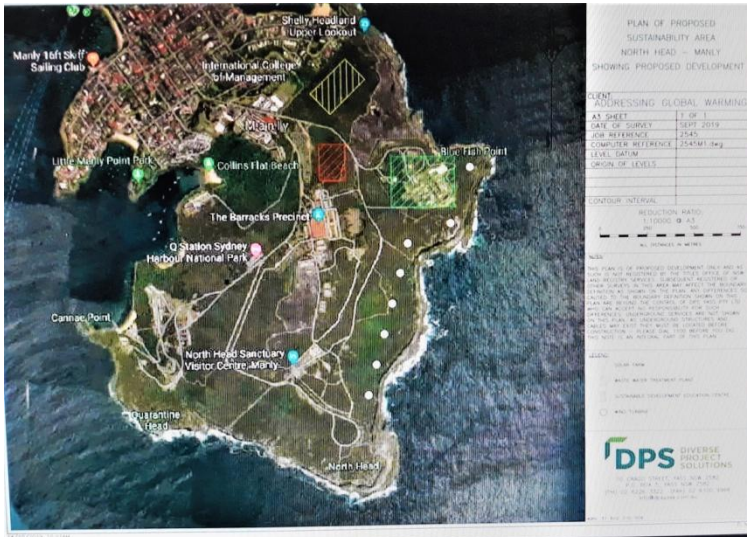
SOS (Save Our Surroundings)

Without Prejudice

A research paper prepared by SOS Central West NSW November 2020

- A proposal for eight wind turbines, a one hectare solar farm, and an environmental sustainability centre on land at North Head on The Northern Beaches of Sydney is not supported by 'green' politicians Zali Steggall MP Warringah, James Griffin MP Manly and Michael Regan Mayor of NBC. All three have all stated they do not support the proposal for a wind farm at North Head, but that such developments are more appropriate in the Renewable Energy Zones in Western NSW, i.e. over 100s of kilometres from where they are well out of their sight from their electorates.

[ref: www.northernbeachesadvocate.com.au/2020/07/17/politicians-oppose-wind-farm]



Wind, solar & sustainability centre proposal for North Head, NBC Sydney

- There is now significant opposition by rural citizens in Germany to any more wind turbines. So much so that the construction of new wind IEGW collapsed in 2019.
[ref: [ft.com/content/d8b9b0bc-04a6-11ea-a984-fbbacad9e7dd](https://www.ft.com/content/d8b9b0bc-04a6-11ea-a984-fbbacad9e7dd) "Germans fall out of love with wind power"]
- Victoria's Corangamite Shire Council has unanimously rejected a proposal for a massive 550 hectare **solar farm** at Bookaar near Camperdown. The Rural City of Wangaratta has voted to oppose construction of a new \$170 million solar farm at Glenrowan.
[ref: 25/9/18 www.standard.net.au/story/5667482/huge-solar-farm-gets-flick-from-council; 30/8/2018 weeklytimesnow.com.au]
- Councils and communities in Victoria reject solar and wind IEGW. e.g. The government pushes 3 wind and 3 solar IEGW on regional communities in Victoria, and, RURAL communities are trying to stop solar farm developments across some of Victoria's prime irrigation land. Sunraysia citrus, dried fruit and winegrape growers have joined lifestyle-block owners in campaigning against three solar developments of 75,000 panels being built next to their properties.
[ref: www.theaustralian.com.au/nation/politics/ "communities forgotten in Victoria's rush to renewables"; weeklytimesnow.com.au "Rural communities campaign against solar farms"]
- Communities around the world reject wind and solar IEGW. e.g. Mexico: *One killed and 20 injured in wind farm protest. Mexico: Unhappy residents have also managed to stop at least four other solar and two wind projects in Yucatán, again due to the lack of prior consultations and environmental impacts.* USA: *Pennsylvania Richmond Township supervisors rejected a proposal that would have allowed a solar panel project to move forward.* USA: *North Carolina Woodland rejected rezoning application for a solar farm. But then they went further, supporting a complete moratorium on new solar farms, after residents made their opposition crystal clear.* UK: *The Say No to Sunnica action group is*

not against solar, we are not 'NIMBY's' (Not in My Back Yard) but do not agree with losing our entire back yard to a scheme (solar farm with batteries) that is simply too large and too intrusive.

[ref: wind-watch.org/news/2011/11/03/one-killed-and-over-20-injured-in-mexican-wind-protest; 5/5/20 dialogochino.net/en/climate-energy/35244-mexican-communities-reject-chinese-solar-yucatan/; 14/12/15 *Roanoke-Chowan News-Herald*; 5/5/20 wind-watch.org/news/2020/05/11/mexican-communities-reject-chinese-solar-farm-in-yucatan/; wind-watch.org/news/2020/05/09/mexican-government-halts-grid-connection-of-new-solar-and-wind-projects; 13/10/20 readingeagle.com/news/environment/richmond-township-supervisors-reject-zoning-change-for-solar-farm/; 14/12/15 SMH "Woodland North Carolina reject solar farms"; www.saynotosunnica.com]

- On 14 July 2020 the Benton Public Utility District of Washington State, USA, issued a report detailing many scientific and economic reasons why they now oppose wind turbine IEGW. Just one of the points made was: *"Customers and citizens throughout the region are desirous of the natural beauty and open spaces that are part of their way of life. This is the reason for the report and for their formal declaration that Benton PUD does not support further development of wind power in the PNW. The PUD's position is consistent with a recent decision in California as the San Bernardino County's Board of Supervisors slammed the brakes on big industrial solar projects and highlighted a challenge for the huge landscaping demands of renewable intermittent electricity"*.

The rural regions of Australia totally agree with these points as we are the people affected by having wind and solar IEGW thrust onto us, without regard for the health of us and our environment.

[ref: <https://wattsupwiththat.com/2020/10/12/washington-state-blows-away-wind-fantasies/>]

- Bob Brown, environmentalist, founder and long-time leader of the Australian Greens Party opposes a major wind farm development because its towers will affect an area's natural beauty and could kill endangered wildlife without any economic benefit to the state. Many communities throughout Australia, mainly in the rural regions, are those who are the most impacted by such developments.

[ref: 15/07/19 the-guardian.com; 25/07/19 abc.net.au]

- Two long-time, well known environmentalists, Michael Moore (documentary "Planet of the Humans" YouTube 21/04/20) and Michael Shellenberger (book "Apocalypse Never: Why Environmental Alarmism Hurts Us All" 30/06/2020) highlight the environmental damage being caused by the obsession many countries have for weather-dependent renewables.

[ref: stopsolarfarms.com/news/i-cried-wolf-on-climate-change-says-michael-shellenberger]

9. Are reliable

This claim is not supported by the facts, real world experience and logic, such as:

- As wind and solar electricity generation are weather-dependent, then by definition, they cannot ever provide a continuous 24/7 energy supply in themselves. During August and early September 2020 California had several days of rolling blackouts affecting hundreds of thousands of homes, despite demand falling short of the state's peak years. The Governor proposed extending the planned forced shut-down of gas-fired plants past 2020 to counter the unpredictable renewables output.
[ref: [latimes.com 24/08/20 "The power went out. Now California might let these gas plants stay open" 4/9/20 "State of emergency declared as California faces historic heat, possible power outages" ; www.nytimes.com 16/8/20 "Rolling blackouts in California have power experts stumped"](https://www.latimes.com/2020/08/24/la-fi-california-power-outage-0824)]
- Likewise, the Australian electricity grid is becoming more and more unstable and unreliable as more weather-dependent renewables are added. The AEMO, who manages the grid, has proposed several measures, including their right to remotely shut down roof top solar systems, and charge owners of roof top solar systems to pay to export excess electricity to the grid, in an effort to prevent increasing frequency of blackouts.
[ref: reneweconomy.com.au/aemo-sees-urgent-need-to-have-power-to-switch-off-rooftop-pv-94963/amp/]
- In parts of Gulgong NSW, during the 2019-20 summer, there were four unplanned blackouts, three of which were two hours or more duration. Without electricity, many residents were not only without power but also water, as they rely on tank water and electric pumps. The Beryl 87MW IEGW, only 5km west of Gulgong town, was operational since May 2019. The days were cloudy and there may have been equipment failures at Beryl. Was load-shedding ("demand management") the cause of the blackouts?
[ref: reneweconomy.com.au/component-issues-hit-beryl-solar-farm-new-energy-solar-cuts-dividend-89936/]
- Germany relies on alternative back up (e.g. imports electricity from France who generate about **74%** of their electricity from nuclear power at a cost **59%** less than Germany) to keep the country operating when the wind speed is inconsistent, too light or too strong. Australia does not have the luxury on calling on other countries when its electricity system can't cope.
[ref: forbes.com/sites/michaelshellenberger/2019/02/05/if-saving-the-climate-requires-making-energy-so-expensive-why-is-french-electricity-so-cheap/#183179541bd9;
<https://stopthesethings.com/2019/01/06/germanys-renewable-energy-fail-german-co2-emissions-10-times-higher-than-nuclear-powered-france/>]
- Both solar panels and wind turbines lose efficiency over time. Solar panels decline by about **0.5% to 0.8%** a year and wind turbines about **1.6%** a year. They also can suffer failures from deterioration of plastics, solar cells, components, etc. and the weather (e.g. hail, storm, strong winds and fire).
[ref: PV, [www.wholesalesolar.com " How long do solar panels last"](https://www.wholesalesolar.com/how-long-do-solar-panels-last/); Wind: [www.sciencedirect.com "How does wind farm performance decline with age" \]](https://www.sciencedirect.com/science/article/pii/S0959652618300000)



Fire shuts down whole solar array



Wind turbine collapse

- Both solar and wind IEGW have to shut down if a major component fails. For example, just a fire in one turbine requires shut down of the plant. Once a fire starts, the project must be shut down and taken off grid for a period of time as a safety precaution, resulting in lost revenue. Likewise, for example, storm damage to part of a solar array may close down the whole works, such as the Queensland Oakey 2 IEGW.

[ref: [8/9/20 windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/](https://www.windpowerengineering.com/the-true-cost-of-wind-turbine-fires-and-protection/) ; reneweconomy.com.au/uk-developer-takes-write-down-after-another-storm-hits-oakey-2-solar-farm-32373/]



Lightning strike shuts down wind turbine



Oakey 2 wind damage

- On average, Australia, loses 500MW of wind IEGW of output every 3 days. About 50 times a year we get the equivalent of 500MW or more outage within an hour or less when the wind becomes too strong. About 20 times a year a whole wind IEGW region can become becalmed , sometimes for days, causing a loss of output between 2GW and 4GW. Building more IEGW in the same region makes the intermittency worse, not better. To counter this intermittency, base load generation must sit idling ready-to-go to pick up the slack or the Snowy Hydro scheme must sit in reserve. Therefore, capital infrastructure is being used inefficiently for unreliable and expensive wind (and solar) generators. This is an additional cost attributable to adding renewables to grids but is ignored by advocates of renewables

[ref: Aug 2020 joannenova.com.au "Wind power generation intermittency - It's worse than you think it is - Part one"]

- Solar panels deteriorate, resulting in additional lost efficiency, total failure or even fire. e.g. by delaminating /internal corrosion, electrical wiring issues, micro-cracks, hot spots, birds, dust, "snail trails" and inverter problems. These failures can cause significant loss of output for an entire solar array or IEGW.

[ref: <https://www.sunengis.com/nine-common-problems-with-solar-panels/>; reneweconomy.com.au/uk-developer-takes-write-down-after-another-storm-hits-oakey-2-solar-farm-32373/; pveducation.org/pvcdrom/modules-and-arrays/degradation-and-failure-modes]



Examples of some types of PV panel deterioration

10. Are Sustainable

This claim is not supported by the facts, such as:

- Just as coal, gas, and oil have a finite lives so do the many rare earths, metals, and numerous materials needed to produce, to transport, to provide backup support (e.g. Lithium for batteries) to maintain and replace weather-dependent renewables. The growing demand for lithium is already forecast to exceed the world's production supply by 2023 and various scenarios indicate supply could run out between 2040 and 2100. Weather-dependent renewables already need up to ten times the resources (mining raw materials to end-of-life disposal) than required by the equivalent capacity coal, gas or nuclear plants. This enormous magnitude of depletion of Earth's resources for renewables is unsustainable, some of which may disappear even in this century.
[ref: www.pv-magazine.com/2020/09/15/how-long-will-the-lithium-supply-last/; [sciencedirect.com](https://www.sciencedirect.com) "global environmental change Vol 60 Article 102028 table 1; Oct 2020 Dr Lars Schernikau "The truth behind renewable energy"; [manhattan-institute.org](https://www.manhattan-institute.org)/mines-minerals-and-green-energy-reality-check; [nature communications](https://www.nature.com) "renewable energy production will exacerbate mining threats to biodiversity"]
- In 2019, **37%** of known reserves of rare earths, which are used in renewables, as well as many electronic devices, are in China. In 2019 China produced **85-90%** of all rare earths output. That country has already twice threatened to cut off its supply to other countries. If they act on that threat, or even withhold some supply so forcing up prices, then solar and wind renewables expansion and frequent replacement could largely and abruptly cease.
[ref: [statista.com/statistics/277268/rare-earth-reserves-by-country/](https://www.statista.com/statistics/277268/rare-earth-reserves-by-country/); 7/8/20
[forbes.com/sites/timthreadgold/2020/08/07/chinas-rare-earth-threat-sparks-an-international-backlash/](https://www.forbes.com/sites/timthreadgold/2020/08/07/chinas-rare-earth-threat-sparks-an-international-backlash/)
<https://chinapower.csis.org/china-rare-earths/>]
- The huge volume of water needed for mining and processing rare earths is now at risk in China. Widespread water pollution from growing industrial development in China continues to diminish freshwater supplies. The rapid economic growth and the increased consumption of animal products, is putting a further strain on the freshwater resources of China. Priority for human water consumption becomes clear, and this could put the zirconium and rare earths industry way down the list.
The increasing huge amounts of water used by the renewables industry for the life-cycles of their wind, solar and battery products is likely unsustainable in coming decades.
[ref: [investorintel.com/sectors/technology-metals/technology-metals-intel/china-is-facing-a-water-crisis-that-could-threaten-rare-earths-production-and-their-mining-industry/](https://www.investorintel.com/sectors/technology-metals/technology-metals-intel/china-is-facing-a-water-crisis-that-could-threaten-rare-earths-production-and-their-mining-industry/);
- The world has spent \$trillions on all renewables to only get their share of global energy from **22% in 2001 to 34.7% in 2019**. To get to 100% renewables by 2050 is estimated to be many \$trillions (USA alone, \$5.7 trillion).
In the light of the damage done so far to nearly all economies in the world as a result of dealing with the global COVID-19 Pandemic, it is not feasible that these economies can sustain such extraordinarily high expenditures for renewables, including their 100% backup duplication and grid reconfiguration for three more decades.
[ref: <https://www.americanactionforum.org/research/what-it-costs-go-100-percent-renewable/>;
www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Mar/IRENA_RE_Capacity_Highlights_2020.pdf]
- Currently it costs Australians **\$13 billion** annually to support the wind and solar expansion in Australia. However, the AEMO 2020 Integrated Planning Report Overview states a benefit to consumers of only **\$11billion** over **20** years i.e. by 2040.
This meagre benefit will not provide a significant reduction in Australia's already high electricity prices to maintain existing manufacturing let alone significant growth to help

Australia's economic recovery post COVID-19 Pandemic. We need meaningful reductions (50% or more) in our electricity bills. 39% of our bills are already caused by funding renewables and can only increase further if government policies do not change now..

[ref: Report by Dr Moran "The Hidden Cost of Renewables on Electricity Prices"; <https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp>]

- *"Unlike other forms of electricity generation, like nuclear plants or coal plants, there doesn't seem to be any foresight on how to deal with the waste that will be generated when solar panels and wind turbines reach the end of their short lifetimes. Remember, nuclear plants can run for 80 years, as can coal plants with proper maintenance and upkeep, but even the best wind turbines and solar panels will last for just 25 years, creating staggering amounts of waste products."* Waste generated from renewables in the next 30 years is expected to be 866 greater than all the waste produced by nuclear power in the last 50 years. Recycling solar panels in the USA cost 10 times more than the revenue obtained according to a Arizona State University solar researcher Meng Tao.

The disposal of mega tonnes of weather-dependent renewables toxic waste to landfill, storage or by incineration, as currently done in the EU, is not sustainable.

[ref: americanexperiment.org/2020/08/solar-panels-are-starting-to-die-what-will-we-do-with-the-megatons-of-toxic-trash/; 22/07/20 onlinelibrary.wiley.com/doi/abs/10.1002/pip.3316]

- Current technologies of wind and solar renewables are getting close to their theoretical limits of energy efficiency, which is well under 60%, have relatively short lives and need 100% backup due their intermittent operation. Whereas coal, gas and nuclear energy generation are already over 90% efficient, have considerably longer lives, can operate with capacity factors in the 90% plus range and so need minimum backup. In addition, modern coal and gas plants produce much less CO2 emissions than the existing operating plants. Nuclear reactors produce no CO2 emissions, have the longest lives, and the development of small module reactors, will be cheaper and quicker to deploy. Also, new technologies are likely to appear in the next decade or two, such as nuclear fission and hydrogen driven turbines. These new technologies are likely to cause inefficient, intermittent and unreliable weather-dependent technologies to again be abandoned. Placing faith in weather-dependent renewables with battery and hydro as the 100% backup will not be sustainable, as other technologies are improved and invented in the next decade, so leaving renewables as stranded assets and outdated technologies.

[ref: wattsupwiththat.com/2020/10/18/the-truth-behind-renewable-energy/; Michael Shellenberger "Apocalypse Never: Why Environmental Alarmism Hurts Us All" 30/06/2020]

Conclusion

The two drivers of more renewables for electricity generation in Australia are reductions in CO2 emissions so as to reduce future human-induced global temperature rises, and to significantly reduce electricity prices to stimulate the Australian economy, especially in manufacturing. It is clear from the evidence provided in this research paper that neither of these goals can be achieved by more expenditure in renewables, especially weather-dependent renewables with only battery and hydro storage as backup.

All the various claims made by advocates for renewables have been shown to not stand up to scrutiny. At 1.3% contribution to global emissions Australia can not affect global temperatures. The two biggest contributors to global emissions are China and India, who both have about the lowest cost electricity in the world and the smallest renewables percentage for electricity generation.

The countries (e.g. Germany & Denmark) and states (e.g. South Australia and California) with the highest proportion of renewables also have the highest electricity prices and unreliable grids in the world. As Australia continues down the path of more renewables our governments somehow think the we will achieve what no others have so far.

The unspoken tragedies of these government policies is the damage being done to the world's environments, to wildlife and to people in Australia and other countries. How can it be justified to use ten times more resources for environmentally damaging, unreliable, dangerous and intermittent weather-dependent wind and solar renewables than for modern coal, natural gas and nuclear plants?

Just the proposed 10GW solar IEGW in the Northern Territory requires completely clearing (and fencing) at least 150km² of land, including removing all vegetation and existing wildlife. The same MWh output can be achieved at a fraction of the materials and land required (12km²) by only 3.5GW of nuclear power plants, because of their much higher capacity factors. Nuclear also has the advantages over solar of three times the life, three times the output, much less additional infrastructure, a fraction of the lifecycle waste and the ability to provide electricity almost 24/7 with zero CO2 emissions.

Why do our governments ignore the obvious solutions to achieve their stated policies of CO2 reduction, electricity price reductions and job increases? Why do they use CO2 emissions reductions as an excuse when their actions will not affect the climate? Why do they pursue energy policies that reduce our economic activity? Why do they risk the safety of its regional communities? Why do they support large-scale destruction of regional and overseas environments? Why do they think that 100% duplication of weather-dependent renewables at great cost makes economic sense?

By reading this research paper they can no longer continue to proceed on their current course in ignorance.

Appendix A: Definitions

In any discussion about electricity generation it is essential that the various terms used are fully understood as some people mislead others, either accidentally or deliberately, by their incorrect use. The main terms and their acronyms used in this paper are:

- **Megawatt (MW):** A megawatt (MW) is equivalent to 1,000 kilowatts or 1 million watts of electrical energy e.g. a 1MW ("nameplate capacity") wind turbine can, under ideal conditions, produce a maximum of 1MW of electricity at an instant in time. MW and MWac (ac = alternating current) are usually synonymous but MWdc (dc = direct current) is sometimes used as it gives a higher nameplate capacity value, i.e. output before conversion to ac, which involves energy losses.
- **Gigawatt (GW):** A gigawatt (GW) is equivalent to 1,000 megawatts or 1 billion watts.
- **Megawatt hour (MWh):** A megawatt hour is equal to 1,000 Kilowatt hours (KWh). It is equal to 1,000 kilowatts of alternating current electricity used continuously for one hour e.g. a **1MW** wind turbine may only produce over a year **3,240 MWh** of electricity depending on the average strength of the wind. The theoretical maximum annual electricity output for a **1MW** system is **1MW x 24hours x 365 days = 8,760MWh**.
- **Gigawatt hour (GWh):** A gigawatt hour (GWh) is equivalent to 1,000 megawatt hours.
- **Capacity factor:** 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 **3,240MWh** in a year out of a possible **8,760 MWh**, therefore its **capacity factor is $3240/8760 = 37\%$** , which is a typical value for modern wind turbines. For solar panels the typical capacity factor is less than **28%**. 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.
- **Artisanal:** Made in a traditional way by someone who is skilled with their hands; in this paper it refers to Cobalt mining done by hand.

Appendix B: Abbreviations

Acronym	Description
AC or ac	Alternating current (e.g. 240Vac electricity supply to homes)
AEMO	Australian Energy Market Operator
CCGT	Closed Cycle Gas Turbine, also known as Combined Cycle Gas Turbine
CCGT-CC	Closed Cycle Gas Turbine with Carbon Capture
CO ₂	Carbon Dioxide (colourless gas making up 0.04% of the Earth's atmosphere)
C-W REZ	Central-West Renewable Energy Zone
DC or dc	Direct current (e.g. 12Vdc car battery)
EPA	Environmental Protection Agency
EU	European Union
GW	Giga Watts (equals 1000 megawatts)
GWh	Giga Watt hours (equals 1000 megawatt hours)
Ha	Hectares (1 hectare equals approximately 2.471 acres)
IEA	International Energy Agency
IEGW	Industrial Electricity Generating Works (excludes roof-top solar and domestic wind turbines)
IPCC	Intergovernmental Panel on Climate Change
ISP	Integrated System Plan (Annual plan issued by AEMO)
Kg	Kilograms (equals 1000 grams)
Km ²	Square kilometres (one Km ² equals 100 hectares or about 247 acres)
KV	Kilovolts (equals 1000 volts)
KW	Kilowatt (equals 1000 watts)
KWh	Kilowatt hours (e.g. household electricity is billed as cents per KWh)
LCOE	Levelised Cost of Electricity (a method of expressing \$/ MWh over a period of time)
Mj	Mega joule (a measure of energy equals one million joules or 0.27778 KWh)
MW	Megawatt
MWh	Megawatt hour
NEM	National Energy Market (covers QLD, NSW, ACT, Vic, Tas, SA; excludes WA & NT)
NF ₃	Nitrogen Trifluoride (a very potent colourless greenhouse gas)
PV	Photovoltaic
SF ₆	Sulphur Hexafluoride (a highly potent human-made colourless greenhouse gas)
t	Ton or short ton (equals 2000 pounds; used by USA)
T	Tonne or metric ton or long ton (equals 2000kg or 2240 imperial pounds)
TW	Terawatt (equals one million megawatts)
TWh	Terawatt hour (equals one million megawatt hours)
VALCOE	Value-adjusted Levelised Cost of Electricity (developed in 2019 by IEA to reflect more of the revenue timing and costs associated with renewables)

SOS (Save Our Surroundings)

Without Prejudice

A research paper prepared by SOS Central West NSW November 2020

Appendix C: Save our surroundings (in pictures)

This



or This?



This



Or This?



This



This



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Or This?



None of these local animals can get through a PV solar IEGW fence



Like this

