REPRESENTATION #1

From: PlanSA - Submissions <noreply@plan.sa.gov.au>
Sent: Saturday, August 17, 2024 7:52 PM
To: DHUD:SPC Reps <spcreps@sa.gov.au>
Subject: Feedback submitted for Major Development

Form Information

Site Name	PlanSA
Site Id	578867
Page Standard Name	Impact assessed and Crown development submissions
Page Standard Id	921477
Url	https://plan.sa.gov.au/have_your_say/notified_developments/state_developments/major_projects_impact_assessed_submissions
Submission Id	1396495
Submission Time	17 Aug 2024 7:52 pm
Submission IP Address	206.83.113.134

Development Details

Applicant:	Department for Energy and Mining EPS Energy
Development Number:	24019147
Nature of Development:	Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and connection to the national electricity grid through either Robertstown Substation or Bundey Substation.
Subject Land:	**Lot 31 and 32 Junction Road, Geranium Plains (SE31 and SE 32 of H200400: CT 5400/625), 957 Lower Bright Road, Geranium Plains (SE30 of H200400: CT 5974/451), and Lot 2 Pipeline Road, Geranium Plains (SE2 of H200400: CT 5978/775).** Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and connection to

	the national electricity grid through either Robertstown Substation or Bundey Substation.
Contact Officer:	Laura Kerber
Phone Number:	(08) 7133 2371
Close Date:	21 Aug 2024

Contact Details

Name: Ia

Contact number: 0419993822

Email: banchorynsw@gmail.com

Postal address: Banchory, 458 Lakes Road, Walcha NSW 2354

Affected property: Numerous

Submission Details

I am:	a private citizen
I am - Other:	
My position is:	I oppose the development
Do you have concerns regarding the proposed development?:	Yes
What could be done to address your concerns?:	Refuse the application.
Other general comments:	Please see my attached submissions which outline my objection to this and all industrial soilar farm developments.
PresentInPerson:	I do not wish to be heard in support of my representation
NominatedSpeaker:	

Supporting Documents

FilesUp: Solar-Farm-Objection.docx, type application/vnd.openxmlformats-officedocument.wordprocessingml.document, 20.8 KB

FilesUp: Battery-Energy-Storage-System-BESS-Objection.docx, type application/vnd.openxmlformats-officedocument.wordprocessingml.document, 13.3 KB

FilesUp: High-Voltage-HV-Transmission.docx, type application/vnd.openxmlformats-officedocument.wordprocessingml.document, 15.8 KB

FilesUp: No file uploaded

FilesUp: No file uploaded

15 August 2024

Battery Energy Storage System (BESS)

The concept of an industrial lithium battery energy storage system (BESS) is physically, economically, and environmentally flawed. Batteries will never facilitate renewable energy to be 24/7 dispatchable, and with a 2-hour depth are incapable of driving modern industry on any real scale. This pursuit is a total waste of taxpayers' money and is causing willful destruction to the natural environment and untold human misery in mining (tenfold that of fossil fuels) the trace elements required in battery manufacture.

What is needed is reliable affordable 24/7 baseload and peaking electricity generated by anthracite (black coal burnt at HELE power plants), nuclear and natural gas fueled power stations. Not geopolitically sensitive and environmentally harmful industrial batteries sourced from supply chains and then made in factories controlled by China, thus exposing Australia's energy security and ultimately our national security.

Ian McDonald, Walcha Grazier

6 August 2024

High Voltage (HV) Electricity Transmission:

Because wind and solar '*renewable'* energy generation is widely acknowledged as being inherently weather dependent, there is a belief by AEMO that this intermittency of power supply can be averaged out by regional interconnectors, which it hopes will improve reliability through geographic diversity. If one region is experiencing a wind or sun drought, then AEMO hopes other regions won't be and will generate enough surplus power to supply the ones that are short.

Nation building is not built on the hope that something might work, but on proof that it will work, long before committing hard funding. There is no proof whatsoever that a massive overbuild in HV transmission will solve the basic flaw of wind and solar generated electricity, that is it is weather dependent. Power lines are more susceptible to faults and blowing over during severe weather conditions, and the longer the high voltage grid stretches across our continent, the greater the likelihood there will be of interruptions to supply resulting in blackouts. More power lines will only compound and further exacerbate the underlying problem of '*renewable*' energy, and that is it is totally dependent on idyllic wind and sunlight.

Analytical economic social and environmental studies together with indisputable modelling need to be carried out by independent experts *(at arm's length from AEMO & CSIRO)* before any more money is wasted on excess HV transmission, transmission that will only encourage an imprudent overbuild in wind and solar farms. Further expansion (*completely unnecessary if the nuclear option of* *generating baseload power is implemented alongside existing or brownfield coal-fired power station sites*) of the grid will only cause more harm to the rural landscape and natural environment and render valuable farmland next to worthless.

A consequential reduction in farm values should be an obvious and tangible negative cost of the devil's thread of '*renewable*' energy. It is unacceptable just to pay landowners compensation for easements, when the erosion of property values is realized by all neighbouring properties that are in view of the transmission lines. This negative cost to the broader community needs to be the subject of far greater research and an independent inquiry.

I call on government to adopt the *precautionary principal* and initiate a moratorium on all high voltage transmission applications until further comprehensive research and an independent inquiry is undertaken into its liabilities.

Ian McDonald, Walcha Grazier

15 August 2024

Solar Farms

Contamination of waterways, soil profiles and waste management arising from solar components is acknowledged worldwide as a ticking time-bomb. Presently under Schedule 1 of the POEO Act 1997, electricity works that generate electricity by solar are not scheduled. That means that the DPE, EPA and presumably any LGA is absolved from any responsibility regarding contamination caused or waste arising from solar generation. So, who then is responsible.

Another anomaly with respect to solar farms is Public Liability Insurance. Fires often occur on farms through negligence. If a neighbour to a solar farm is found negligent for starting a fire that spreads into a multimillion-dollar solar farm, the farmer would be sued by the solar farm's insurance company for damages, replacement costs, clean-up costs and loss of income whilst out of operation. A ten or twenty million Public Liability Insurance Policy is not going to cover fire damage to say, a 750-million-dollar-solar farm. So, the solar farms insurance company would more than likely force a property sale on the negligent neighbour to help recover financial damages.

Due to lack of regulation, government continues to accept applications for solar farms in Bush Fire Prone Zones among intensive farming operations and doesn't appear to be aware of the looming insurance issues and unintended financial exposure being caused to neighbouring property owners.

Until such time as both these conundrums have been resolved and environmental and property protection plans have been legislated, I call on the NSW government to apply the ‘precautionary principle’ and initiate a moratorium on all solar farm applications.

Ian McDonald, Walcha Grazier

From: PlanSA - Submissions <noreply@plan.sa.gov.au>
Sent: Wednesday, August 21, 2024 7:39 PM
To: DHUD:SPC Reps <spcreps@sa.gov.au>
Subject: Feedback submitted for Major Development

Form Information

Site Name	PlanSA
Site Id	578867
Page Standard Name	Impact assessed and Crown development submissions
Page Standard Id	921477
Url	https://plan.sa.gov.au/have_your_say/notified_developments/state_developments/major_projects_impact_assessed_submissions
Submission Id	1397663
Submission Time	21 Aug 2024 7:39 pm
Submission IP Address	120.17.101.178

Development Details

Applicant:	Department for Energy and Mining EPS Energy
Development Number:	24019147
Nature of Development:	Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and connection to the national electricity grid through either Robertstown Substation or Bundey Substation.
Subject Land:	**Lot 31 and 32 Junction Road, Geranium Plains (SE31 and SE 32 of H200400: CT 5400/625), 957 Lower Bright Road, Geranium Plains (SE30 of H200400: CT 5974/451), and Lot 2 Pipeline Road, Geranium Plains (SE2 of H200400: CT 5978/775).** Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and connection to the national electricity grid through either Robertstown Substation or Bundey Substation.
Contact Officer:	Laura Kerber
Phone Number:	(08) 7133 2371
Close Date:	21 Aug 2024

Contact Details

Name:	Lynette LaBlack
Contact number:	0432942700
Email:	lynettelablack@live.com
Postal address:	23 Eastlake Drive, Lake Albert, 2650
Affected property:	

Submission Details

I am:	a representative of a company/other organisation affected by the proposal
I am - Other:	
My position is:	I oppose the development
Do you have concerns regarding the proposed development?:	HUGE concerns regarding:- *Unreliable, intermittent Industrialised Solar + BESS is NOT in the interests of consumers - defying National Electricity Law objectives of Price, Quality, Safety, Reliability & Security of Supply of Electricity as well as the Reliability, Safety & Security of the National Electricity System. *AEMO's ISP is

	rubbish - based on Sunk Cost Trickery & Brazen Deception. The CSIRO's GenCost Report has no credibility - debunked by all credible, honest, independent experts who have NO Vested Interests. *AEMO also mistakenly, nonsensically believes they can predict the weather. *The practical reality is that the Robertstown energy project & proposed Robertstown East Solar + BESS project are ECOCIDAL disasters that are the antithesis of clean & sustainable. Instead they are toxic contaminating RenewaBULL JUNK that is ripping off Fake Green subsidies from the Australian public for unreliable, weather dependent, intermittent, insecure power that is NEVER available on demand & will make us reliant on the CCP's CONtrolling, sabotaging agenda & its slave labour supply chains. *According to AEMO's long term data, Solar only has an actual average capacity factor of 17% so the Proponent's weather dependent claims of potentially powering 144,000 homes is ludicrous & impossible. Incapable, prohibitively costly, filthy, FIRE hazardous BESS are no answer. *This plan is a LAND GRAB - turning our irreplaceable, productive land into CONTAMINATED WASTELAND. Robertstown Solar + BESS DOES NOT PROTECT FOOD PRODUCTION - defying the Paris Agreement-Article 2(b)- as do all large-scale Solar/Wind/BESS on food resource land. *There are no benefits, only substantial detrimental impacts with an elevation in GHG emissions due to embedded energy & leaking of the most potent GHG SF6 from 'renewable' switch gear, circuit breakers, Solar processes - highlighting Australia's Fake Green Solar/Wind Energy Poverty Grift & Ponzi Scheme/Scam.
What could be done to address your concerns?:	An immediate Moratorium on the RenewaBULL Disaster & a full Audit of all connected Energy Companies & Networks - as to who is subject to the CCP's National Intelligence Law. Solar Inverters & EV's manufactured in China can be remotely disabled & there is no way that the CCP should be controlling/owning any critical energy infrastructure - including 46.56% of ElectraNet's unnecessary Project Energy Connect which will enable Beijing to turn our lights off! Listen to the Australian people at the next Election as there is NO SOCIAL LICENCE for this sabotaging Solar + BESS plan, nor for Project Energy Connect - emanating from Robertstown Substation, VNI West or HumeLink plans - designed to make Australia weak & China stronger. Dump the Fake Green RenewaBULL Curse & unnecessary Interconnector Nightmare & build far superior Australian Power - including new Ultra Super Critical, High Efficiency, Low Emission Coal Power Stations & a full Supply Chain for a Nuclear Power future with minimal environmental footprint.
Other general comments:	As a severely impacted victim of Cheung Kong Infrastructure's Spark Infrastructure/KKR & co./Malaysian Tenaga Nasional's Bomen Solar monstrosity - the Environmental Vandalism caused to our wonderfully productive & pretty Eunony Valley/Bomen/Wagga Wagga area by these Fake Green subsidy miners is Against the Best Interests of Australia & NOT FOR THE GREATER GOOD!
PresentInPerson:	I wish to be heard in support of my representation
NominatedSpeaker:	Grant Piper - Farmer under Compulsory Acquisition - cursed by reckless 'renewable'/Transmission Nightmare & Chair of National Rational Energy Network.

Supporting Documents

FilesUp:	Miskelly_-_Storage_Requirements_for_100-percent_Renewables_05-03-2024.pdf, type application/pdf, 102.0 KB
FilesUp:	IPA-Submission-Safeguard-Mechanism-Amendment.pdf, type application/pdf, 7.8 MB
FilesUp:	def1e850215a0568270eae03b45d35fbe1e94226.pdf, type application/pdf, 15.0 MB
FilesUp:	9B061623-4EE4-42C7-8130-7DDCCE954AE9.jpeg, type image/jpeg, 140.7 KB
FilesUp:	358309DF-23A9-4FBE-9949-A3F07599BB81.jpeg, type image/jpeg, 215.4 KB

From: lynette lablack <lynettelablack@live.com>
Sent: Wednesday, August 21, 2024 9:28 PM
To: DHUD:SPC Reps <spcreps@sa.gov.au>
Subject: Robertstown East Solar + BESS Development Number: 24019147 Nature of Development: Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and co...

Robertstown East Solar + BESS Development Number: 24019147 Nature of Development: Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and connection to the national electricity grid through either Robertstown Substation or Bundey Substation - OBJECTION Submission.

Please add this Reference to my online Objection.
Thank you.

Lynette LaBlack
lynette lablack@live.com

Reference:-
***Paul Miskelly's - Storage requirement for 100 percent Renewables on the Eastern Australian Grid - Initial Findings**

From: lynette lablack <lynettelablack@live.com>
Sent: Wednesday, August 21, 2024 9:27 PM
To: DHUD:SPC Reps <spcreps@sa.gov.au>
Subject: Robertstown East Solar + BESS Development Number: 24019147 Nature of Development: Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and co...

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Please add these References to my online Submission.

Thank you.
Lynette LaBlack

Reference:
****TWO NEW PRECEDENTS HAVE BEEN SET** by Oxley Bridge Rd Uranquinty Solar Determination 24th Nov 2022 - NEW MODERN SLAVERY CONDITION & AMENDED STORMWATER MANAGEMENT PLAN (re CONTAMINATION.)

****Professor Ian Plimer's 3 minute presentation regarding Solar Panel Contamination Risks.**
PPSSTH-149 - DA22/0122 - 1268 Oxley Bridge Road Uranquinty 2652
https://www.planningportal.nsw.gov.au/planning-panel/electricity-generating-works-solar-farm-8

**Hail Storm Photos & Industrialised Solar Contamination Risk to Our Reliably Productive Food Bowl at Bomen, Wagga Wagga Photo are included via this link also - the Hail Stones & some of the Fractured Solar Panels from the damaging 31st Oct 2020 event that left masses of broken Solar panels in situ for a shocking 10 - 11 months without Due Care - with some panels still remaining fractured & leaching contaminating heavy metals years later!

1. NEW MODERN SLAVERY CONDITION- requiring proof prior to construction that NO Slave Labour supply chain components be used in construction.
****New Condition Inserted C4A - Dealing With Modern Slavery.**
Commonwealth Modern Slavery Act 2018

*NSW Local Council Act 1993
428 Annual Report
438 ZE Duty to Ensure Goods & Services Are Not Procured From Modern Slavery.

This applies to all NSW Government Bodies - including Councils - for those who Host, Procure or have a Power Purchase Agreement with Solar/Wind Energy Generation/BESS whose construction has used Modern Slavery Supply Chain Sourced Components
eg. City of Sydney, the Opera House, Kiama, Shoalhaven, Shellharbour Councils & Westpac, etc. have an unethical PPA with Spark Infrastructure's Xinjiang Jinko Solar based Bomen Solar - unethically Hosted by Wagga City Council.
REROC has an unethical PPA with Iberdrola - with Xinjiang JA Solar based Avonlie Solar - unethically Hosted by Narrandera Shire.

2. AMENDED STORM WATER MANAGEMENT PLAN CONDITION re-CONTAMINATION – QUALIFIED TESTING/REPORTING, CONTAMINATION RESPONSE PROCEDURE, etc.

****Amended Condition C8.**
Prior to Commencement of Any Works - Storm Water Management Plan.
On Site & Discharge From the Site.
Testing Points & Regular Water Samples, Suitably Qualified Person.
Written Response Procedures if CONTAMINATION is Found - required PRIOR to CONSTRUCTION.
Availability of Results.

****AN IMMEDIATE MORATORIUM & AUDIT OF ALL ENERGY/NETWORK COMPANIES IN AUSTRALIA IS ESSENTIAL PRIOR TO ANY FURTHER APPROVALS - SUCH AS THIS DETRIMENTAL ROBERTSTOWN EAST SOLAR + BESS PLAN - TO ENSURE NO CRITICAL ENERGY INFRASTRUCTURE CONTROL, SUPPLY & DISTRIBUTION, ENERGY COMPANIES/NETWORKS ARE SUBJECT TO THE CCP's NATIONAL INTELLIGENCE LAW.**
ALSO, THAT NO ENERGY COMPONENTS ARE ABLE TO BE REMOTELY DISABLED BY HOSTILE ENEMIES/BAD ACTORS.

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

Further References regarding the complete inadequacy & unsuitability of incapable Battery Energy Storage Systems have been included:-

<u>Paul Miskelly's</u>:-
****'<u>Storage requirement for 100 percent Renewables on the Eastern Australian Grid - Initial Findings</u>.'**

****'<u>Validity of Claims by Renewable Energy Proponents re No. of Households Served by Proposed Generators</u>.'**

PARIS AGREEMENT

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

"(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, IN A MANNER THAT DOES NOT THREATEN FOOD PRODUCTION."

Unreliable, Intermittent, Solar/Wind/BESS are NOT IN THE INTERESTS OF CONSUMERS - DEFYING NATIONAL ELECTRICITY LAW OBJECTIVES OF:-

***PRICE, QUALITY, SAFETY, RELIABILITY & SECURITY OF SUPPLY OF ELECTRICITY.**

***THE RELIABILITY, SAFETY & SECURITY OF THE NATIONAL ELECTRICITY SYSTEM.**

***NSW Local Council Act 1993**
428 Annual Report
438 ZE Duty to Ensure Goods & Services Are NOT Procured From Modern Slavery.

***New Condition Inserted C4A - Dealing With Modern Slavery.**
Commonwealth Modern Slavery Act 2018

DPHI APPROVAL OF SOLAR/WIND ELECTRICITY GENERATING WORKS & BATTERY ENERGY STORAGE SYSTEMS ON RU1 LAND DEFY THE PARIS AGREEMENT BY THREATENING AUSTRALIA'S FOOD SECURITY AS WELL AS ENERGY SECURITY, ECONOMIC PROSPERITY & NATIONAL SECURITY.

From: lynette lablack <lynettelablack@live.com>
Sent: Wednesday, August 21, 2024 9:21 PM
To: DHUD:SPC Reps <spcreps@sa.gov.au>
Subject: Robertstown East Solar + BESS Development Number: 24019147 Nature of Development: Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and co...

> You don't often get email from lynettelablack@live.com. Learn why this is important

Robertstown East Solar + BESS Development Number: 24019147
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Please add this Reference to my online Objection.
Thank you.

Lynette LaBlack
lynettelablack@live.com

References
Paul Miskelly:- 'Validity of Claims by Renewable Energy Proponents re No. of Households Served by Proposed Generators.'

From: lynette lablack <lynettelablack@live.com>
Sent: Wednesday, August 21, 2024 9:31 PM
To: DHUD:SPC Reps <spcreps@sa.gov.au>
Subject: Robertstown East Solar + BESS Development Number: 24019147 Nature of Development: Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and co...

You don't often get email from lynettelablack@live.com. Learn why this is important

I have submitted my Objection comments for Robertstown East Solar + BESS & included some files. Hopefully, it has been received as it was a very slow 'Sending' process.

I have additional references to be included - which I am now emailing.
Thank you.

Kind Regards,

Lynette LaBlack
lynettelablack@live.com
Ph: 0432942700

Robertstown East Solar + BESS Development Number: 24019147 Nature of Development: Construction of the Robertstown East Solar project comprising: 300MW photovoltaic modules, associated infrastructure and ancillary works (temporary and permanent), and connection to the national electricity grid through either Robertstown Substation or Bundey Substation - OBJECTION Submission.

Please add these references to my online submission.
Thank you.

References:

****DEFIES NATIONAL ELECTRICITY LAW**

AEMO, and everyone in 'authority', place primacy on emissions target rather than the other requirements of the NEL. The emissions requirement was only added to the NEL in Sep 2023, and the NSW Emissions Reduction Act 2023 was only passed in Nov 23 (other states were similarly tardy to legislate any targets), - so on what basis did any Gov act prior to that to impose all this on us? Yet they all did, and still emphasise emissions over other objectives. NEL is made in the SA Parliament, and in the 2nd reading, the minister there also reiterated that all objectives are equal.

7 National electricity objective:

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to-

(a) price, quality, safety, reliability and security of supply of electricity; and

(b) the reliability, safety and security of the national electricity system; and

(c) the achievement of targets set by a participating jurisdiction-

(i) for reducing Australia's greenhouse gas emissions; or

(ii) that are likely to contribute to reducing Australia's greenhouse gas emissions.

**** *AEMO CEO Must Be Sacked For Failing To Ensure Affordable, Secure And Reliable Energy Supply - 15th Dec 2023**
https://ipa.org.au/ipa-today/aemo-ceo-must-be-sacked-for-failing-to-ensure-affordable-secure-and-reliable-energy-supply
Australians need affordable and reliable energy, not a regulator advocating for ideologically based outcomes that will undermine our energy security."
"The current situation Australia finds itself in with record and rising energy bills, forecast blackouts, and an increasingly unreliable energy grid, are all core features of the policy of net zero emissions. It is all pain for no environmental gain," said Mr Wild.

****Community Impact Survey: April-May 2024 – Property Rights Australia**
https://propertyrightsaustralia.org.au/community-impact-survey-april-may-2024/

****Sediment Run-Off Contaminating Land/Water - Court Case -**
"Created, Operated, and Maintained a Nuisance"
Solar farm runoff pollutes property, couple awarded $135 million - CFACT
https://www.cfact.org/2023/06/06/solar-farm-runoff-pollutes-property-couple-awarded-135-million/
By Bonner Cohen, Ph. D. |June 6th, 2023

25th Oct 2023 update ...A federal judge has dramatically reduced a jury's $135 million award to a Georgia couple (https://www.ajc.com/news/couple-awarded-135m-after-solar-project-turns-their-lake-to-mud-hole/BZ6BYXQREJCDROQV6ZASUW5WOI/) whose property was fouled by muddy runoff from a solar project next door down to $5 million, after objections from the plaintiffs in the case.
In an order issued Monday in the Middle District of Georgia, Judge Clay D. Land wrote that the punitive damages awarded to the couple were worth many magnitudes more than the property that was damaged, and therefore were excessive.
Unsurprisingly, connected with this RenewaBULL Junk ruination is the Woke, virtue signalling, GREENWASHING of the BIG TECH, BIG ENERGY USER DATA CENTRE:-
'Solar development was built to serve a data center owned by the parent company of Facebook'

****Professor Ian Plimer's 3 minute presentation regarding Solar Panel Contamination Risks.**
PPSSTH-149 - DA22/0122 - 1268 Oxley Bridge Road Uranquinty 2652
https://www.planningportal.nsw.gov.au/planning-panel/electricity-generating-works-solar-farm-8

****Leaching Via Weak Spots in Solar Panels**
https://www.researchgate.net/publication/348883160_Leaching_via_Weak_Spots_in_Photovoltaic_Modules

****Embedded Energy & CO2**
The Starting Step for the Production Of Pure Silicon....$SiO_2 + C \rightarrow Si + CO_2$ ....IS the Heart of the Solar Panel!

****Every step in the production of Solar PV power systems requires an input of fossil fuels** - as the carbon reductants needed for smelting silicon from ore, to provide manufacturing process heat and power, for the intercontinental transport of materials, and for on-site deployment.
https://www.azbackroads.com/around-the-west/rangefire-massive-amounts-of-coal-and-wood-must-be-burned-to-create-solar-panels/

****Coal's Importance For Solar Panel Manufacturing – Watts Up With That?**
https://wattsupwiththat.com/2024/05/23/coals-importance-for-solar-panel-manufacturing/

****200 Million Tonnes of Toxic Solar Panels Destined For Landfills Near You**
stopthesethings.com

****Contamination from Galvanised Steel supports**
https://www.facebook.com/share/p/srbXaCbKgVXocgsm/?mibextid=xfxF2i

James Falcsik White County Indiana Residents Against Solar
21 h ·
The hazardous materials that exist in solar panels receive a lot of attention out of concern they will leach out into the soil over time, especially if they are damaged by weather events. Has anyone considered what happens to the soil and ground water on a farm that is converted to thousands of acres of solar panels, with tens of thousands of buried ten-foot-long galvanized steel I-Beams driven into the soil to support the racking systems?

The 13-acre solar farm I worked on used more than 900 galvanized steel columns. Now I am an electrical guy, not a farmer or an agricultural specialist. The zinc coating of galvanized steel corrodes at a higher rate in soils with a Ph lower than 7.0. It gets more complicated when copper is present and the soil acts as an electrolyte. When galvanized steel corrodes it can leach cadmium, lead, and zinc into the soil. In fact, the EPA warns that “cadmium can be released to drinking water from the corrosion of some galvanized plumbing and water main pipe materials.” The USDA states “galvanized metal containers are not safe to serve food and drinks in. The acidity of the food or drink could dissolve the zinc coating allowing it to leach into the food or drink.” So, what happens to the rich agricultural soil that is made a pin cushion by all these galvanized steel columns that support solar panels for 25 years? Does this make a case for base line soil and ground water testing as part of solar zoning requirements BEFORE a solar developer starts to build, and periodic testing for the life of the solar facility? The solar developer should also bear the cost of this testing, not the taxpayer.

****The Photovoltaic Heat Island Effect: Larger Solar Power Plants Increase Local Temperatures**
(University of Arizona Science & Technology Parks Solar Zone)
https://www.nature.com/articles/srep35070

****Heat Effects of Industrialised Solar**
On a Qld state government web site you can look up to see if a FIRE 🔥 is going. It is a satellite image of reflective heat. It shows LARGE SOLAR FACTORIES to be on FIRE 🔥 when they aren't. It's picking the heat coming off the panels!

Electrical Engineer Paul Miskelly's opinion:-

"The energy in the sunlight that strikes solar cells that is not converted to electricity will be absorbed and converted to heat. This will be re-radiated to the atmosphere. There goes your unconverted 80 percent.
By comparison, even though plants re-radiate the energy in the green part of the visible spectrum - that's why they look green - clearly they are doing a lot better job of absorbing and using the energy in the other parts of the visible spectrum than can solar cells. That this is correct is confirmed by the satellite image of reflective heat.
That looks to be irrefutable evidence that solar panels re-radiate heat, and lots of it."

SOLAR ELECTRICITY GENERATING WORKS ARE THUNDERSTORM & TORNADO INCUBATORS & MAGNETS!

Subject: Opinion from USA Aerospace Engineer who is also fascinated by physics and climate science:-

George Franklin:
Solar panels are at best about 20% efficient. They convert almost 0% of the UV light that hits them. None of the visible spectrum and only some of the IR spectrum. At the same time as they are absorbing light they are

absorbing heat from the sun. This absorbed heat is radiated into the adjacent atmosphere. It should be obvious what happens next. When air is warmed it rises. Even small differences in ordinary land surfaces are capable of creating powerful forces of weather like thunderstorms and tornadoes. These weather phenomena are initiated and reinforced by land features as they are blown downwind. It is all too obvious to me what will happen with the heat generated by an entire solar farm. Solar farms will become thunderstorm and tornado incubators and magnets.
Solar panels are dark and and they emit energy to the space above them when they are not being radiated. This is known as black-body radiation. Satellites flying in space use this phenomenon to cool internal components. If they didn't do this they would fry themselves.
So solar farms not only produce more heat in summer than the original land that they were installed on, but they also produce more cooling in winter, thus exacerbating weather extremes.
So I conclude with this. There is nothing green about green energy except the dirty money flowing into corrupt pockets.
There is no such thing as green energy. The science doesn't exist. The technology doesn't exist. The engineering doesn't exist. We are being pushed to save the planet with solutions that are worse than the problems."

Whole of life-cycle Green House Gases
*Neither has there been any calculation made for the **most potent Green House Gas of all** - man-made SF 6 - leaking from Solar manufacturing, Wind Turbines & increased Switch Gear & Circuit Breakers.....

Wind turbines contains the worlds most powerful green house gas, SF6. bergensia.com	<cropped-Bergensia-mobile-logo-180x180.png>

Why Are Massive Amounts of the World's Most Potent Greenhouse Gas Being Ferried Out into the Ocean off the Eastern Seaboard? 28/6//24
https://lindabonvie.substack.com/p/why-will-thousands-of-pounds-of-the

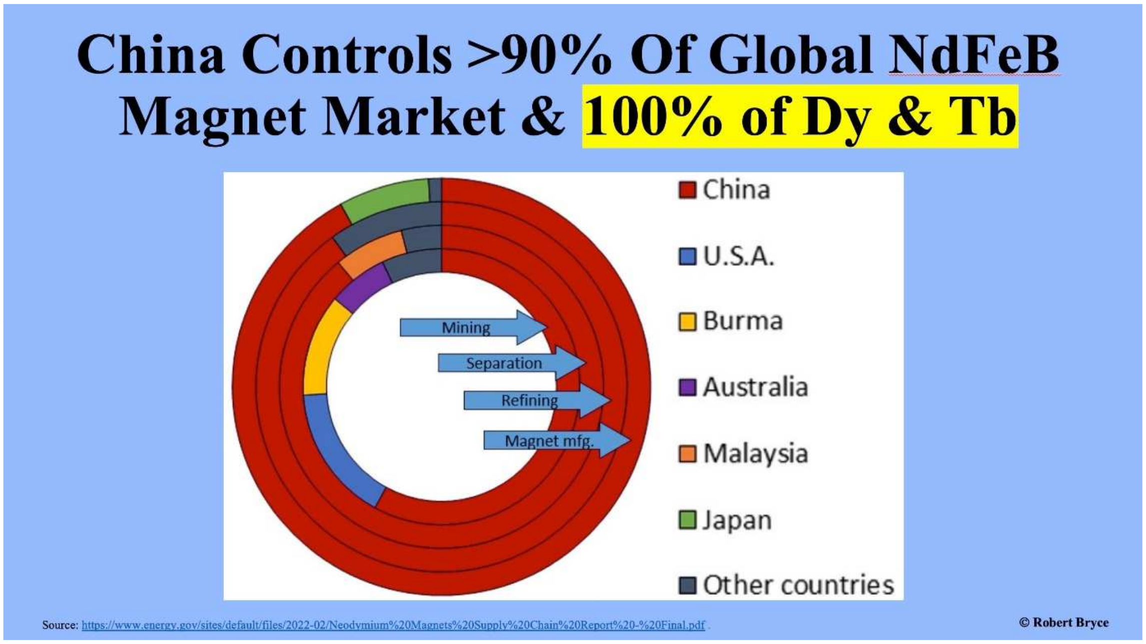
***National Security Nightmare**
https://www.senatorpaterson.com.au/news/chinas-spy-threat-to-energy-supplies
There are no secure measures currently in place to prevent malicious actors from using Solar Inverters to disrupt the Solar Electricity Grid.

https://www.aspistrategist.org.au/does-chinas-rapid-rise-in-the-australian-car-market-pose-a-security-risk/

***"In July, Transgrid struck a deal with China's ZTT International for the delivery of more than 17,500 kilometres of high-voltage conductors to get ahead on HumeLink and VNI West." 4th Dec 2023**
https://reneweconomy.com.au/transgrid-hands-out-multi-billion-dollar-contracts-for-controversial-humelink-build/m

The Government has no measures to protect new energy sources from malicious actors!

21st April 2024 - Robert Bryce



Last May, in "The EPA's China Syndrome," I explained how the proposed mandate on EVs would make the U.S. dependent on China for "neodymium-iron-boron (NdFeB) magnets. Those magnets are critical components in electric vehicles and wind turbines as well as in military applications like ship propulsion systems and guided-missile actuators." The EPA has completely ignored the magnet supply issue. In fact, the word "magnet" doesn't appear one time in the agency's 1,200-page final tailpipe rule.
This is pure foolishness. In 2022, the Commerce Department issued a heavily redacted report on Chinese magnets and the threat they pose to our security. As I wrote last May, the report found:
America's dependence on imported NdFeB magnets meets the statutory definition of threatening national security. Here's the key sentence: "Based on the findings in this report, the Secretary concludes that the present quantities and circumstances of NdFeB magnet imports threaten to impair the national security as defined in Section 232 of Trade Expansion Act of 1962, as amended." It continued, noting that the U.S. "has extremely limited capacity to manufacture NdFeB magnets and is nearly one hundred percent dependent on imports to meet commercial and defense requirements. In 2021, the United States imported 75 percent of its sintered NdFeB magnet supply from China.

****NSW Fire & Rescue - SARET Research:-**
"There is a general lack of guidance and provisions in building codes, standards, and legislation in relation to safety to address the potential risks from these emerging technologies. Part of the problem is that we do not yet know enough about their probability of failure, their mechanisms of failure and potential consequences of failure."

****Gateway Energy Storage System Fire: Otay Mesa, CA - YouTube**
https://www.youtube.com/watch?v=A7UY4ioP4VQ

**https://youtu.be/d-hvsz2tyhc?si=S16_g1LWETu1pj70.
Add yet another Lithium Battery FIRE 🔥- this one in Scotland - Lithium Battery Recycling Centre.

****Bouldercombe battery fire sparks warning for residents in regional Queensland - 26/09/23**
https://www.9news.com.au/national/bouldercombe-battery-fire-sparks-warning-for-residents-in-regional-queensland/b4b3058a-cb0b-4209-a02d-6b12d80c63ac

***The 'Sunk Cost' Trickery That Makes Renewables Seem Cheaper Than They Are - 23rd July 2023.**
https://www.fresheconomicthinking.com/p/the-sunk-cost-trickery-that-makes?utm_medium=web
AIDAN MORRISON

How CSIRO justifies the exclusions: “Sunk Cost”
But wait, this deception is so brazen and transparent.......
All of these tens of billions of dollars of projects are explicitly excluded from the cost of integrating renewables.

***Unravelling AEMO’s Integrated System Plan: World-class, Incompetent, or corrupt?**
https://youtu.be/mFcaZ0fgWzk

***Counting the Cost: Subsidies For Renewable Energy - The Centre for Independent Studies**
https://www.cis.org.au/publication/counting-the-cost-subsidies-for-renewable-energy/

***More misinformation from CSIRO on Nuclear**
https://www.cis.org.au/commentary/video/more-misinformation-from-csiro-on-nuclear-copy/

Nuclear VS Renewables: What Will It Cost? | Zoe Hiltonhttps://www.youtube.com/watch?v=Mw_AX9WaJ08

https://youtu.be/J50hWO2DKHc
Adi Paterson - You are being Conned
GenCON Report & equating AEMO & the Government with Animal Farm!

* **Energy Transition Masquerade: The $360 Billion You Pay - YouTube**
https://www.youtube.com/watch?v=x0NKDozvO58

Storage requirement for 100 percent Renewables on the Eastern Australian Grid - Initial Findings

Executive Summary - Notes for policymakers

As stated in the Conclusions below:
It would seem that Australian government authorities have not performed and made publicly available any analysis that provides any indication whatsoever, in a readily understandable way, how many "Big Batteries" will be required in Eastern Australia to meet the 100-percent Renewables' Storage requirement, how they will be sourced and paid for, what are the energy requirements for their production, what are the waste disposal and CO2 emissions resulting therefrom, importantly, where these batteries are to be sited, and, given their relatively short service life, how they will be recycled and re-used.

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

The findings of this analysis are:

From an analysis based on the AEMO Operational Demand data for calendar year 2023, to even begin to consider a 100-percent Renewables scenario for the Eastern Australian Grid:

1. The present wind and solar energy facilities complement will need to be increased, as a minimum, by a factor of 3.31.
2. The minimum Storage Requirement to provide coverage during the worst extreme, prolonged minima in output of the renewables, must be able to supply the full Demand for a minimum period of 24 days. This translates to a Storage Requirement of 12,077,136 MWh, equivalent to some 27,000 Geelong Big Batteries, or some 94,000 Hornsdale Big Batteries.

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

Some 27,000 Geelong Big Batteries would occupy an area, a minimum area, of some 54,000 hectares. This does not include the area required for the corridors for the necessary connecting transmission lines. It is clear that government policy is to acquire rural lands for this purpose, rural lands which are predominantly farmland, that is, land used for food production. This makes it a very significant land grab. This land take is in addition to the considerable amount required for the additional wind and solar "farms", each of which itself constitutes a very significant land grab.

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

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

"This Agreement… aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

"(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, **in a manner that does not threaten food production";** See: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf .

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

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

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

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

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

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

Policymakers also need to consider the following:

1. Neither the required units of renewable generation nor the battery storage units "grow on trees" or "pop out of thin air". At present, all such units are fully imported, increasingly from suppliers whose intentions toward Australia are recognised by Australia's Security Services as being rather less than benign. At any time, these suppliers could impose a trade embargo on the supply of this equipment, instantly posing a profound risk to National Security. See also Wilson (6).

2. Each Geelong-scale Big Battery will occupy the space, involve the land take, as quoted above, of an AFL football stadium, and then some. Where and how are are some 27,000 Geelong Big Battery equivalents going to be sited?

3. What considerations have been given to the transmission line requirements to connect so many of these grid-scale batteries to the Eastern Australian Grid?

4. Where are these grid-scale batteries to be manufactured? What amount of CO_2-producing fossil-fuels will be required to mine the ore, extract, refine and manufacture, the enormous number of battery modules required?

5. Given the massive scale of the battery requirement, and the known probability of risk of fire, the provision and cost thereof of permanent firefighting facilities and staff, similarly on a massive scale, must be factored into the operations of these battery storage units.

Abstract

Francis Menton, in a recent article (1) , discusses a scholarly paper by a certain Balazs Fekete and colleagues (2), and a blog post article by Fekete himself (3), discussing their experiences in getting the paper published. In the paper, Fekete *et al* concluded, for the fairly large region of the US that they considered, comprising 18 adjoining northeastern States, that a value of storage, equivalent to some 25 percent of the total annual demand for that region, is the minimum requirement. On an average demand basis, this 25 percent is equivalent to some 91.25 days of demand.

Putting that into the Eastern Australian context, 25 percent of annual demand for the year 2023, based firmly on AEMO operational data, is some 20,970 MW (the average annual demand for 2023), times 24 hours/day times 365 days/year times 25 percent, or, 45,924,300 MWh.
To put that number into some sort of real item of equipment, that is the equivalent of 102,054 Geelong Big Batteries. (The Geelong BB has a stated storage capacity of 450 MWh.)
Clearly, these are enormous numbers, implying an enormous and unprecedented infrastructure requirement, the like of which has never been attempted in Australia, if indeed anywhere.

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

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

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

Methodology

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

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

This process, as Menton (1) observes, is very similar to the procedures used in normal financial profit and loss accounting. It is important to mention “deficits” because, at present, given that the renewables capacity on the Eastern Australian grid is still far short of being able to supply the present demand requirement, running this accumulation process with the current values of the renewables’ subtotals quickly results in a very large, negative value, that is, a large deficit, and hence a failure to supply sufficient generation to meet demand.

Before atempting the analysis, it is useful to attempt to place limits on the various likely values, where that is possible. For example, what might be the maximum possible value of the Required Storage, presuming the absolute worst-case conditions?
As the lower limit, the Required Storage cannot be less than zero.
Presumably, the absolute maximum value might be that required to meet one year’s Demand. (It may safely be presumed that having all forms of generation shut down for more than a year, which is what this value implies, would be deemed to be totally unacceptable.)
This value is readily determined: Average Demand (MW) times 24 hours times 365 days per year, Inserting the value for Average Demand for calendar year 2023 in the equation:
20966.7409399774 MW times 24 times 365 MWh per year, resulting in a value for the upper limit of the maximum Required Storage of: 183,668,651 MWh (per year).
The range for the value of the Required Storage that would meet the variations in the Total Demand during one year, must lie somewhere within the range: [0 - 183,668,651] MWh.

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

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

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

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

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

I thought to look at other possibilities, first doing a search of the hydrology literature on such as: "sizing resevoir storage to match demand". I found the following, potentially useful, link: "https://engineeringnotes.com/water-engineering-2/storage-resevoir/how-to-determine-capacity-of-a-storage-resevoir"
Two methods were described, the second being what is called the "Mass Curve method". What became clear here was that, in order to determine the required storage, in any run, the initial storage in the resevoir must be such that, on commencing the march through the timesteps during, for example, one calendar year of 5-minute timesteps,

A first step to a "Real" Battery Scenario

As it is of absolute importance to obtain the best estimate of the storage requirement, I thought to give due consideration to the very real losses in using battery storage. As a first step to including these very real losses in any practical battery storage configuration, I thought, from the outset, to consider the case of the "non-ideal" battery. In a recent email citing a paper at: https://www.windtaskforce.org/profiles/blogs/battery-system-capital-costs-losses-and-aging , Willem Post cites the following recommendation from Tesla, the manufacturer of the Hornsdale "Big Battery" in South Australia, that to maximise battery life:
"The 40% throughput is close to Tesla's recommendation of 60% maximum throughput, i.e., not charging above 80% full and not discharging below 20% full, to achieve a 15-y[ear] life, with normal aging". See also Post (7) for a comprehensive discussion of grid-scale battery losses.

In determining the accumulating storage then, I needed, at the very least, to ensure that at all times that:

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

What became clear from the use of the hydrologist's methods is that any iterative attempt at predicting the required storage must presume that the chosen storage is at full capacity at the commencement of the iteritive procedure.
Also, it seemed sensible to chose an initial value for the multiplier/s such that the average value of the total available renewables-supplied generation, (that is, wind plus solar far plus Rooftop PV plus hydro), is equal to, or just slightly greater than, the average demand for the period under consideration, here the calendar year 2023.

Results

In summary, after trialling many iterations using different multiplier values, I found that the multiplier 3.31 is required, with a storage requirement equivalent to 24 days of average demand. This requirement, remembering that the total storage required is 1.25 times the actual storage required to balance the demand, (given that the storage may be filled to no more than 80 percent of capacity), is 12,077,136 MWh. This then is the storage required to be able to balance demand at all times throughout calendar year 2023.

Giving some sort of context to what this bare number means -
it corresponds to 26,842 Geelong Big Batteries, or, 93,633 Hornsdale Big Batteries.

It is useful to compare the latter with an estimate by Paul McArdle, which I understand is some 70,000 -80,000 Hornsdale Big Batteries. But I further understand that Mr McArdle presumed, as a reasonable first approximation to obtaining a ball-park figure, that the batteries are “ideal”: he did not attempt to address such practicalities as, available storage vs the required storage, transmission losses, two-way trip losses, redundancy required based on battery failure frequency, etc.

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

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

1. Impact on CO2 emissions reductions calculations

With a requirement of some 30,000 “Big Batteries”, there is a clear requirement on the authorities that they determine an accurate estimate of the CO2 emissions resulting from the mining, milling, refining, manufacture of the colossal amounts of materials required for the production, transport and site preparation for this huge number of “Big Batteries” required. That the resulting CO2 emissions might occur in countries outside of Australia does not excuse the requirement for the necessary accounting: any resulting CO2 emissions are released into the same atmosphere.

2. Recycling Burden

Any realistic estimate gives a battery lifetime of some 10-15 years at most. How will it be possible to develop efficient, both in materials and energy efficiency, and effective, recycling and re-use regimes to process such horrendous quantities of waste battery materials? Uttering pious words that “a circular economy will be developed” with no thought as to the detail, as NSW Planning, for example, is doing at the present time, is merely a strategy of leaving the resolution of these horrendous problems to future generations. For a realistic estimate as to the extent of the waste disposal issue, see Mills (4).

3. Environmental Impacts

Given that the Geelong “Big Battery” requires a land-take that is at least equivalent to that of one of Victoria’s Australian Rules Football Stadiums, there is an urgent need to address the likely environmental impacts of what is, by any estimation, a huge land-take requirement. Also worth emphasising is that there can be no argument as to land-use of the land-take required for a BESS. These behmouths occupy the entirety of the land on which they are constructed. There is also the land take required for the enormous amount of overburden and waste rock generated by the mining and milling operations required in the winning of the necessary materials required for the batteries. Again, see Mills (4).

4. Fire Risk

At present, various EIS reports for BESS proposals usually emphasise the risk of fire damage TO the proposed BESS facility from bushfires. There seems to be no account taken of the likely damage to the vicinity of any BESS resulting from fires that start within the facility itself. That there is a very real risk of fires starting in these facilities during, say, a fast-charging scenario, seems at present to be almost totally ignored in these proposals. That there is such a very real risk is indicated by the high rate of fires occurring in domestic premises resulting from the presence of active, in-use batteries of the same Lithium-Ion technology. To think that such a level of risk can be ignored when of the order of 30,000 Geelong Big Batteries is the requirement, is simply fanciful.

5. National Security Concerns

As each of these "Big Battery" installations takes up a huge area, poses a significant fire risk due to the Lithium-ion technology used, and that there will be potentially so many of them, these big batteries constitute a very real National Security risk. It is not inconceivable that a determined aggressor, using something as simple as a concerted drone attack, could set out to destroy these installations, resulting in Eastern Australia a firestorm that would make, for example, the fire-bombing of Dresden during WWII, look like a village bonfire in comparison. That a grid-wide blackout resulting in the total paralysis nationally for some weeks would be the inevitable result of such an attack seems to be an almost incidental consequence. There is also the very real risk that a cyber attack on any potential "back-door", built in by foreign suppliers, could be used to shut down the batteries instantly, at any time, producing widespread blackouts. Why have governments seemingly given no thought to the likelihood of such a scenario? See, for example, Prins *et al* (5) for a UK perspective of the likely devastating impacts on National Security that so-called "Net Zero" policies are already causing and increasingly will have in Britain. For the Australian context and perspective, the excellent paper by Wilson (6) is recommended unreservedly. This paper not only discusses the, entirely negative, impacts of the present policies supporting renewables in Australia, it also provides a foundational basis for the meaning of Energy Security.

Conclusions

This initial analysis indicates that something of the order of the equivalent of some 30,000 Geelong "Big Batteries" will be required to even begin to address the storage requirements of a 100-percent Renewables scenario for the Eastern Australian grid at present electricity Demand requirements. This figure of 30,000 does NOT address the round-trip losses necessarily resulting from the generation, storage, and later release of electrical energy from that storage. Accounting for these very real losses would merely <u>increase</u> the required battery storage figure.

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

It is instructive, I think, to quote from the paper of Fekete *et al* (2), where they summarise the outcome of their extensive literature search on the topic of the need for the requirement for backup and/or storage to support intermittent renewable generation:

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

Similarly, as far as I am able to determine, no relevant Australian government authority has performed and made publicly available any analysis that provides any indication whatsoever, in a readily understandable way, such as how many “Big Batteries” will be required in Eastern Australia, how they will be sourced and paid for, what are the energy requirements for their production, the waste disposal and CO_2 emissions resulting therefrom, where these batteries will be sited, and, given their relatively short service life, how they will be recycled and re-used.

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

Pursuing this grand dream of “Renewable Energy Superpower” for Australia is, to use a term of Mark Mills, “an exercise in magical thinking”. Put simply, it is time that this nonsense ceased.

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4 March 2024
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From the desk of Saxon Davidson, Research Fellow
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Institute of Public Affairs

25 January 2023

Committee Secretary
Senate Standing Committees on Environment and Communications
PO Box 6100
Parliament House
Canberra ACT 2600

Submission to the Inquiry into Safeguard Mechanisms (Crediting) Amendment Bill 2022

Dear Committee Secretary,

The purpose of this letter is to share research and analysis conducted by the Institute of Public Affairs ("the IPA") into Australian energy policy with the Senate Standing Committees on Environment and Communications ("the committee") as it conducts its inquiry into the Safeguard Mechanisms (Crediting) Amendment Bill 2022 ("the bill"). Attached to this are three research reports, one from February 2021 titled *Net Zero Jobs: An analysis of the employment impact of a net zero emissions target in Australia*, one from April 2022 titled *The Economic and Employment Consequences of Net Zero Emissions by 2050 in Australia*, and one from June 2022 titled *Australia's Net Zero Energy Crisis: An Analysis of the Electricity Price Implications of Net Zero Emissions by 2050*.

On the basis of the IPA's research, the IPA recommends the repeal of section 3H of the *National Greenhouse and Energy Reporting Act 2007* and the repeal of *The Climate Change Act 2022* in its entirety, which would have the effect of repealing Australia's commitment to net zero emissions by 2050.

Background

The bill is part of a larger policy agenda which includes the increase of federal regulatory powers to limit greenhouse gas emissions under Part 3H of the *National Greenhouse and Energy Reporting Act 2007*. The bill and its associated regulations are a capstone policy item as part of the federal government's aim to achieve net zero emissions by 2050.

Australia is currently experiencing an unprecedented energy crisis, with power prices surging and baseload power sources (coal and gas), of which Australia has an abundance of, being phased out to pursue the policy of net zero.

IPA research has identified that meeting the policy of net zero will require the cancellation of all 89 coal, gas, and oil projects currently in the construction pipeline. This would entail the cancellation of approximately half a million jobs, the vast majority of which are in regional Australia.

Many of these projects are, at this moment, expected to be replaced by wind and solar generated power. At mass scale, wind and solar are experimental and untested, and, as yet, do not have a demonstrated ability to provide reliable, base-load power. In addition, the jobs in the renewable sector are, on average, lower quality than jobs in mining. For example, over nine in ten jobs in the coal sector are full time, and mining pays double the economy-wide average. Jobs in solar farms, for example, are temporary, as once construction and installation is completed, the only notable ongoing jobs are in maintenance, which are typically lower paid and less likely to be full time.

Over 8 in 10 Facilities Targeted by the Safeguard Carbon Tax are in Regional Australia

IPA analysis of the 2020-21 Safeguard Facility Data reveals that 84% of the facilities that will be affected by the safeguard policy are in regional Australia. The added regulatory burden that the bill will put on these facilities will put at risk thousands of jobs. This is another example of how climate and emissions policies, such as net zero, which are developed and promoted by inner-city elites, disproportionally impact Australians living in the regions. These findings are consistent with IPA research from 2021.

The attached IPA research report, *Net Zero Jobs: An analysis of the employment impact of a net zero emissions target in Australia,* found that the policy of net zero puts over 650,000 jobs at risk, and that these jobs are unlikely to be replaced by jobs in the renewable energy sector. The vast majority of these jobs are in regional Australia, with many of them in the facilities that will be affected by the bill and the associated regulations as part of the government's net zero agenda.

Further analysis by the Institute of Public Affairs has found that 88% of the facilities that the bill and its associated regulations will target are in critical industries that are vital to Australia's prosperity and national security:

- 48% of the facilities are in coal, gas, and/or oil,
- 28% Other Mining (such as iron, copper, and gold),
- and 12% Manufacturing.

The increased regulatory burden placed on these industries will limit Australia's self-reliance in a time of regional instability and geographical uncertainty.

Net Zero is Making Energy Unreliable and Unaffordable

Trends in Europe have recently pointed to an understanding that coal and gas are more reliable sources of energy than wind and solar.

In July 2022, the European Union Parliament voted to classify natural gas as a sustainable form of energy. Additionally, Germany, who had been a leading European country as a consumer of wind and solar generated energy, began reactivating coal fired power plants to halt reliance on Russian gas and prevent blackouts during their winter.

Australia has an abundance of coal and gas, enough to ensure domestic supply of energy and to export onto the global market simultaneously.

Yet, AEMO announced on the first day of the 2022 winter that gas rationing may be necessary to prevent rolling blackouts across the Australian east coast, rather than expanding the use of coal and gas. The policy of net zero is preventing businesses and even state government owned corporations from investing in Australia's domestic coal and gas market, artificially lowering Australia's energy supply and increasing energy demand.

According to the attached IPA research report '*Australia's Net Zero Energy Crisis: An Analysis of the Electricity Price Implications of Net Zero Emissions by 2050'*, under the policy of net zero, Australian households can expect household prices to double by the end of the decade. This is due to the absence of equivalent replacement energy sources in the electricity grid. The replacement energy sources, wind and solar, are intermittent and cannot provide energy under all circumstances unlike coal or gas.

I wish to thank the Committee for the opportunity to provide this submission. Please do not hesitate to contact me on sdavidson@ipa.org.au for further consultation or discussion. We welcome the opportunity to appear before the Committee in due course.

Kind regards,

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February 2021

NET ZERO JOBS

AN ANALYSIS OF THE EMPLOYMENT IMPACTS OF A NET ZERO EMISSIONS TARGET IN AUSTRALIA

Cian Hussey, Research Fellow
Daniel Wild, Director of Research

Institute of Public Affairs

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Introduction

Australia is facing increased international pressure to adopt a target of achieving net zero carbon equivalent emissions (CO_2-e) (hereafter referred to as emissions). With the election of President Joe Biden in the United States, who has re-committed to the Paris Agreement, this pressure will only increase in the lead up to the Glasgow Climate Change Conference in late 2021.

Adopting a net zero emissions target will come at great expense to Australians, who have already seen jobs destroyed and their electricity bills increase as a result of ill-conceived policies aimed at reducing emissions.

The 2019 election provided firm evidence that Australians reject the idea of risking jobs and economic prosperity for the sake of reducing emissions. The election was framed as the 'climate election' by the political left,[1] whose policies were rejected by the Australian people after they failed to give regard to the negative impact those policies would have on the economy and society.

Since 2019, the Coalition government has begun to shift its positioning on emissions. In January 2020, Prime Minister Scott Morrison refused to commit to a net zero emissions target, arguing that people who do so "make a glib promise about that and they can't look Australians in the eye and tell them what it will mean for their electricity prices, what it will mean for their jobs."[2] By early 2021, however, the Prime Minister conceded that the government's goal was to achieve net zero emissions, although there is yet to be a commitment to doing so by 2050.[3]

This report presents an analysis of the effects of a net zero emissions target on jobs. It is broken up into three sections.

The first section finds that a target of net zero emissions would impose significant and irreparable economic and social damage due to the infliction of mass job losses. This report estimates that up to 653,600 jobs would be directly put at risk from a net zero emissions target. This estimate does not include potential indirect job losses which could occur in related industries and the communities where at risk jobs are vital.

Potential job losses are concentrated, in order, in the agricultural sector (306,000 jobs), the primary metal and metal product manufacturing sector (74,100 jobs), the electricity supply sector (64,100 jobs), coal mining (62,000 jobs), and air and space transport sector (38,100 jobs).

1 Adam Morton, "The climate change election: where do the parties stand on the environment?," *The Guardian*, 12 May 2019, https://www.theguardian.com/australia-news/2019/may/12/the-climate-change-election-where-do-the-parties-stand-on-the-environment.

2 Andrew Tillett and Mark Ludlow, "No net zero emissions target if it hurts jobs: PM," *Australian Financial Review*, 20 January 2020, https://www.afr.com/politics/federal/no-net-zero-emissions-target-if-it-hurts-jobs-pm-20200120-p53t18.

3 Greg Brown, "Politics of carbon has ended, Scott Morrison declares," *The Australian*, 22 January 2021, https://www.theaustralian.com.au/nation/politics/politics-of-carbon-has-ended-scott-morrison-declares/news-story/fa662d7b2af40426f852b9f1c18946b8; Phillip Coorey, "PM inches closer to net zero by 2050," *Australian Financial Review*, 1 February 2021, https://www.afr.com/politics/federal/pm-inches-closer-to-net-zero-by-2050-20210201-p56ybg.

The second section provides an analysis of Commonwealth electoral divisions and ranks electorates by those which contain the most jobs put at risk from a net zero emissions target. This report finds that 17 of the top 20 electorates with jobs put at risk by a net zero emissions target are currently held by the Coalition government. Two (Hunter and Lyons) are held by the Labor Party and one is held by Katter's Australian Party (Kennedy). The top 10 seats with jobs at risk are all Coalition-held.

The Coalition is also over-represented in the bottom 20 electorates ranked by at risk jobs, holding a total of 12 seats. This reveals an underlying tension within the Coalition as it relates to their stance on a net zero emissions policy: the Coalition holds the majority of seats which are likely to suffer the most job losses as a result of a net zero emissions target, but it also holds the majority of seats which are least likely to suffer job losses as a result of such a target.

The final section outlines recent changes in the labour force, demonstrating that for each new renewable activity job created between 2009-10 and 2018-19, five manufacturing jobs were destroyed. Renewable activity jobs are those principally engaged in the production of renewable energy, or the design, construction or operation and maintenance of renewable energy infrastructure.[4] The majority of jobs created since the election of the Rudd government in 2007 have been in industries with high public sector employment, and the promise of new, green jobs to replace manufacturing ones has not materialised.

A net zero emissions target would destroy communities where there is a high reliance on relatively more energy-intensive jobs. Adopting such a target in the wake of the largest economic contraction and employment crisis in recent memory, caused by lockdowns implemented in response to COVID-19, would be devastating for Australian workers.

4 Australian Bureau of Statistics, "Employment in Renewable Energy Activities, Australia methodology," April 2020, https://www.abs.gov.au/methodologies/employment-renewable-energy-activities-australia-methodology/2018-19.

Jobs put at risk by net zero emissions target

This report uses data from the *National Greenhouse Gas Inventory by Economic Sector* report published by the Department of Industry, Science, Energy and Resources, along with industry employment data from the Australian Bureau of Statistics, to estimate how many jobs would be placed at risk from a net zero emissions target.

A net zero emissions target will have the greatest impact on jobs that are relatively more energy intensive. As such, 'at risk' jobs are calculated as the total number of jobs in industries where emissions per job are above the economy-wide average of 0.22 kt CO_2. There are 10 industries in Australia where emissions per job are higher than this average, and the jobs in these industries are deemed at risk.

The industries where jobs would be placed at risk by a net zero emissions target are: agriculture; forestry and logging; coal mining; oil and gas extraction; petroleum and coal product manufacturing; non-metallic mineral product manufacturing; primary metal and metal product manufacturing; electricity supply; waste collection, treatment and disposal services; and air and space transport.

Agriculture refers to the growing and cultivation of horticultural and other crops, along with the controlled breeding, raising, or farming of animals. A typical worker in this industry could be employed as a beef cattle or dairy farmer.

Forestry and logging includes logging native or plantation forests, including felling, cutting, and roughly chopping logs into products such as railway sleepers or posts. Also includes cutting trees and scrubs for firewood. A typical worker in this industry could be employed cutting or felling trees.

Coal mining refers to the extraction of coal, and includes underground and open cut mining, along with operations related to mining activities (such as crushing, screening, washing). A typical worker in this industry could be employed as an excavator operator on a coal mine.

Oil and gas extraction refers to producing crude oil, natural gas or condensate through the extraction of oil and gas deposits. This includes activities such as natural gas extraction, petroleum gas extraction, and oil shale mining. A typical worker in this industry could be employed as a drill rig operator on an oil rig.

Petroleum and coal product manufacturing refers to transforming crude petroleum and coal into intermediate and end products, for example petroleum refineries, asphalt paving mixture and block manufacturing, and petroleum lubricating oil and grease manufacturing. A typical worker in this industry could be employed as a mechanical technician in a petroleum refinery.

Non-metallic mineral product manufacturing includes the manufacturing of glass, ceramic, cement, lime, plaster, and other non-metallic mineral products. A typical worker in this industry could be employed as a cement crusher operator in a cement manufacturing plant.

Primary metal and metal product manufacturing includes activities such as iron smelting and steel manufacturing, copper, silver, lead, and zinc smelting and refining, and aluminium smelting. A typical worker in this industry could be employed as a steel cutter in a steel manufacturing plant.

Electricity supply includes electricity generation, transmission, distribution, on selling electricity, and electricity market operation. A typical worker in this industry could be employed as a lineworker maintaining power lines.

Waste collection, treatment and disposal services includes the collection, treatment and disposal of solid, liquid, and other waste types, including hazardous waste; this includes landfills, combustors, incinerators, and compost dumps, but does not include sewage treatment facilities. A typical worker in this industry could be employed as a garbage truck driver.

Air and space transport includes air freight and passenger transport services, along with aircraft charter, lease or rentals with crew. A typical worker in this industry could be employed as a flight attendant.

Table 1 below shows the total number of people employed in each of these industries, and therefore how many jobs are placed at risk by a net zero emissions target.[5] Together, these industries are responsible for 78.3% of total emissions,[6] and employ 653,600 Australians. A list of all industries and the emissions per job is shown in Table 2.

Table 1: Industries with above average emissions per job

Industry	Jobs at risk
Agriculture	306,200
Primary Metal and Metal Product Manufacturing	74,100
Electricity Supply	64,100
Coal Mining	62,000
Air and Space Transport	38,100
Waste Collection, Treatment and Disposal	37,800
Oil and Gas Extraction	32,400
Non-Metallic Mineral Product Manufacturing	28,900
Petroleum and Coal Product Manufacturing	6,300
Forestry and Logging	3,800
Total	653,600

Source: IPA, ABS.

Note: Numbers may not add to the total due to rounding.

5 Australian Bureau of Statistics, "Labour Force, Australia, Detailed, December 2020," January 2021, https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia-detailed/dec-2020.

6 Department of Industry, Science, Energy and Resources, "National Greenhouse Gas Inventory by Economic Sector: 2018," Australian Government, May 2020, https://www.industry.gov.au/data-and-publications/national-greenhouse-gas-inventory-by-economic-sector-2018.

Table 2: Average emissions per job by industry

Industry	Emissions per job (kt CO_2)
Electricity Supply	2.7205251
Oil and Gas Extraction	1.4474496
Petroleum and Coal Product Manufacturing	0.772735
Coal Mining	0.5702873
Forestry and Logging	0.3472612
Non-Metallic Mineral Product Manufacturing	0.3464191
Primary Metal and Metal Product Manufacturing	0.3440861
Agriculture	0.338292
Waste Collection, Treatment and Disposal Services	0.2595126
Air and Space Transport	0.2369107
AVERAGE	0.22
Gas Supply	0.1624972
Chemical, Polymer and Rubber Product Manufacturing	0.1321899
Aquaculture	0.1020797
Rail Transport	0.0786029
Metal Ore & Non-Metallic Mineral Mining & Quarrying	0.0751363
Water Supply, Sewerage and Drainage Services	0.0729917
Fishing, Hunting and Trapping	0.0556844
Road Transport	0.0474011
Other Transport, Services, Postal and Storage	0.0301497
Food Product, Beverage and Tobacco Product Manufact.	0.0189193
Agriculture, Forestry and Fishing Support Services	0.0144851
Wood, Pulp, Paper and Printing	0.0134398
Textile, Leather, Clothing and Footwear Manufacturing	0.0129719
Fabricated Metal Product Manufacturing	0.0119534
Heavy and Civil Engineering Construction	0.011543
Construction Services	0.0104959
Information Media and Telecommunications	0.0060873
Administration, Public Administration and Services	0.00592
Building Construction	0.0032787
Wholesale and Retail Trade	0.0024282
Finance, Insurance, Rental, Hiring and Real Estate	0.0024063
Transport and Machinery Equipment Manufacturing	0.0022129
Other Services	0.0018086
Accomm., Food Services, Education and Health Services	0.0010584
Professional, Scientific and Technical Services	0.0008304
Furniture and Other Manufacturing	0.0005159
Arts and Recreation Services	-0.0034578

Source: IPA, ABS, Department of Industry, Science, Energy and Resources.

Note: This is the most granular breakdown of emissions data by industry/sub-industry available from the Department of Industry, Science, Energy and Resources. As such, not all industries are at the same ANZSIC classification level.

Electoral analysis of at risk jobs

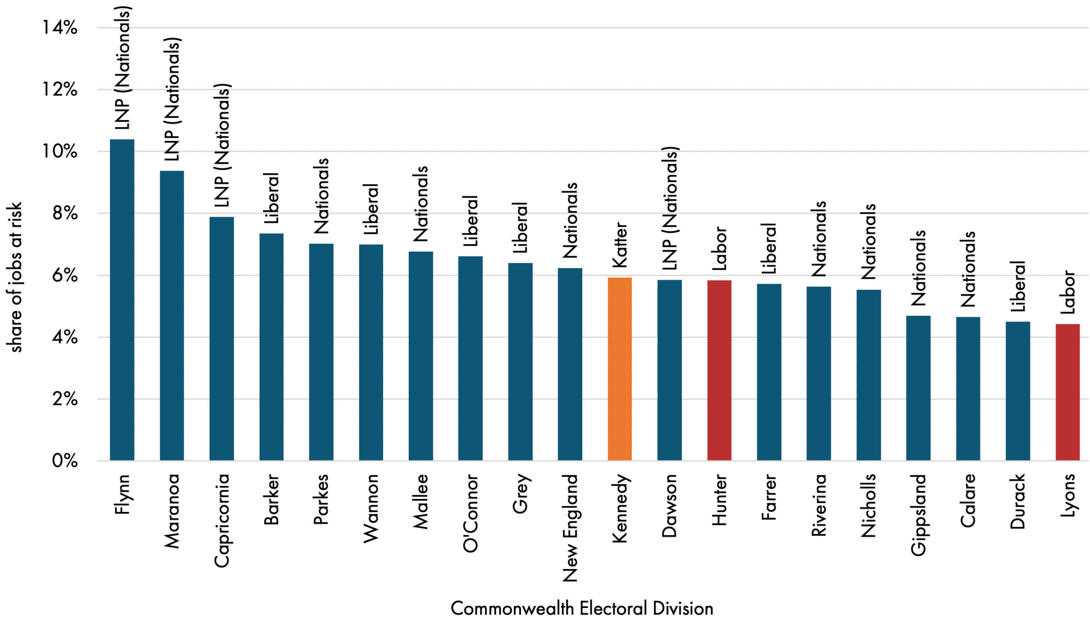
While the 653,600 jobs placed at risk by a net zero emissions target should be concerning for all members of parliament, the burden of these job losses will not fall equally across electorates.

Chart 1 below shows the top 20 electorates ranked by the share of jobs in that electorate which are placed at risk by a net zero emissions target. For example, in Flynn, 10.4% of all employment is in at-risk industries.

Strikingly, 17 of the 20 electorates are Coalition seats, held either by the Liberal Party (Barker, Wannon, O'Connor, Grey, Farrer, Durack), the National Party (Flynn, Parkes, Mallee, New England, Riverina, Nicholls, Gippsland, and Calare), or the Liberal National Party (Maranoa, Capricornia, and Dawson). Only two seats are held by the Labor Party (Hunter and Lyons), and the final seat is held by Katter's Australian Party (Kennedy). All of the top 10 electorates are held by a Coalition party, and while the Coalition have ten electorates where more than 6% of all jobs are at risk, Labor have none. Of these top 10 electorates, six are currently held by the Nationals Party Room. Additionally, 73% of the seats in federal parliament held by the Nationals are 'at risk' seats, compared with just 10% of seats held by the Liberals, and 3% of seats held by the Labor Party.

Of these 20 electorates, six are in New South Wales, five are in Queensland, four are in Victoria, there are two each in South Australia and Western Australia, and one in Tasmania.

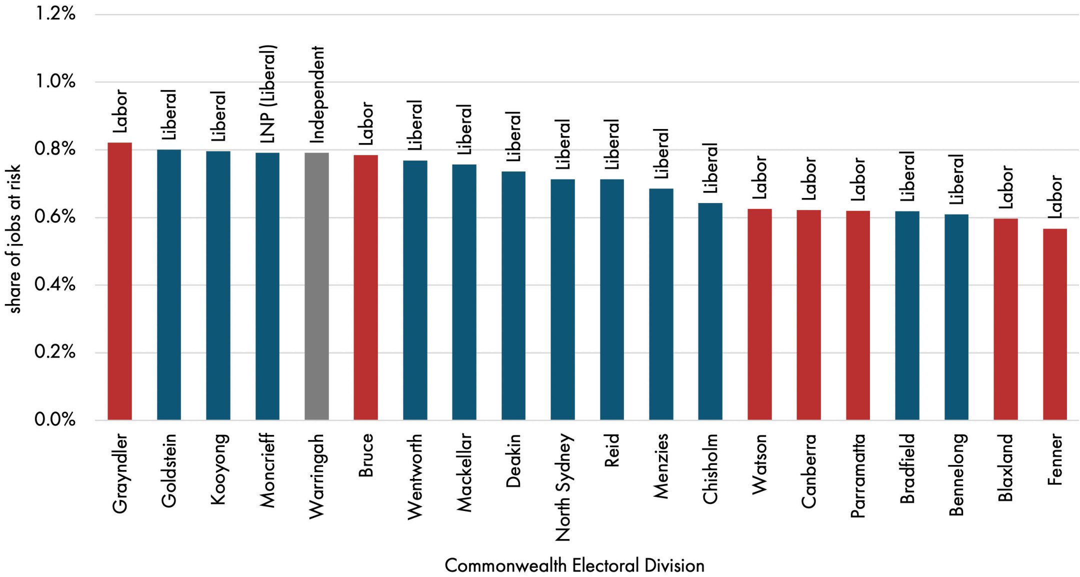
Chart 1: Top 20 electorates with jobs at risk



Source: IPA, ABS.

While the Coalition dominates the top 20 electorates ranked by at risk jobs, it is also over-represented in the bottom 20 electorates ranked by at risk jobs, as shown in Chart 2 below. Of these electorates, 12 are Coalition (Goldstein, Kooyong, Moncrieff, Wentworth, Mackellar, Deakin, North Sydney, Reid, Menzies, Chisholm, Bradfield, and Bennelong), seven are Labor (Grayndler, Bruce, Watson, Canberra, Parramatta, Blaxland, and Fenner), and one is independent (Warringah). This reveals an underlying tension within the Coalition as it relates to emissions reduction policies: the Coalition holds the majority of the seats which are likely to suffer the most job losses as a result of a net zero emissions target, but it also holds the majority of seats which are least likely to suffer job losses as a result of such a target.

Chart 2: Bottom 20 electorates with jobs at risk



Source: IPA, ABS.

'Green' jobs have not offset destruction of manufacturing jobs

Workers are often assured that their livelihoods will not be put at risk by a net zero emissions target because, while such a target will destroy jobs, this will be offset by the creation of new jobs in renewable and related industries. The effort to reduce emissions to date, however, has seen relatively few jobs created in 'renewable activities', as measured by the Australian Bureau of Statistics and shown in Chart 3 below. Renewable activity jobs are those principally engaged in the production of renewable energy, or the design, construction or operation and maintenance of renewable energy infrastructure.[7]

There are two key concerns with the effect that a net zero emissions target will have on jobs.

Firstly, while some jobs may be created by renewable energy activities and other emission reduction efforts, many of these jobs will not go to those who lose their jobs in the agricultural, manufacturing, and other at-risk industries. According to the *Clean Jobs Plan* set out by the Climate Council, for example, 70% of the 76,000 jobs estimated to be created under the plan are in construction and administrative services. Additionally, one-third of the jobs require minimal training, which means they are low-skill and therefore likely low-paying.[8]

Secondly, these new job creations are unlikely to outweigh the job losses seen in at risk industries. There are a range of estimates for how many jobs could be created by a net zero emissions target, however these fail to consider the negative effect such a target would have on the industries identified in this report. For example, the Australian Greens' *Jobs Plan* taken to the 2019 federal election states that 179,770 jobs could be created under their "renewable energy future" policy.[9] Another estimate, found in Beyond Zero Emissions' *The Million Jobs Plan* claims that 207,100 ongoing jobs could be created by investing in a low-carbon economy.[10] Even if all these jobs were created under a net zero emissions target, they would not outweigh the significant job losses likely to occur in at risk industries.

Past experience shows that while the push for emissions reduction may create some jobs, such as in renewable activities, these will not be enough to offset job losses in other, more energy-intensive industries. Between 2009-10 and 2018-19 employment

7 Australian Bureau of Statistics, "Employment in Renewable Energy Activities, Australia methodology," April 2020, https://www.abs.gov.au/methodologies/employment-renewable-energy-activities-australia-methodology/2018-19.

8 AlphaBeta, "Clean Jobs Plan," Climate Council, July 2020, https://www.climatecouncil.org.au/wp-content/uploads/2020/07/Climate-Council_AlphaBeta-Clean-Jobs-Plan-200720.pdf.

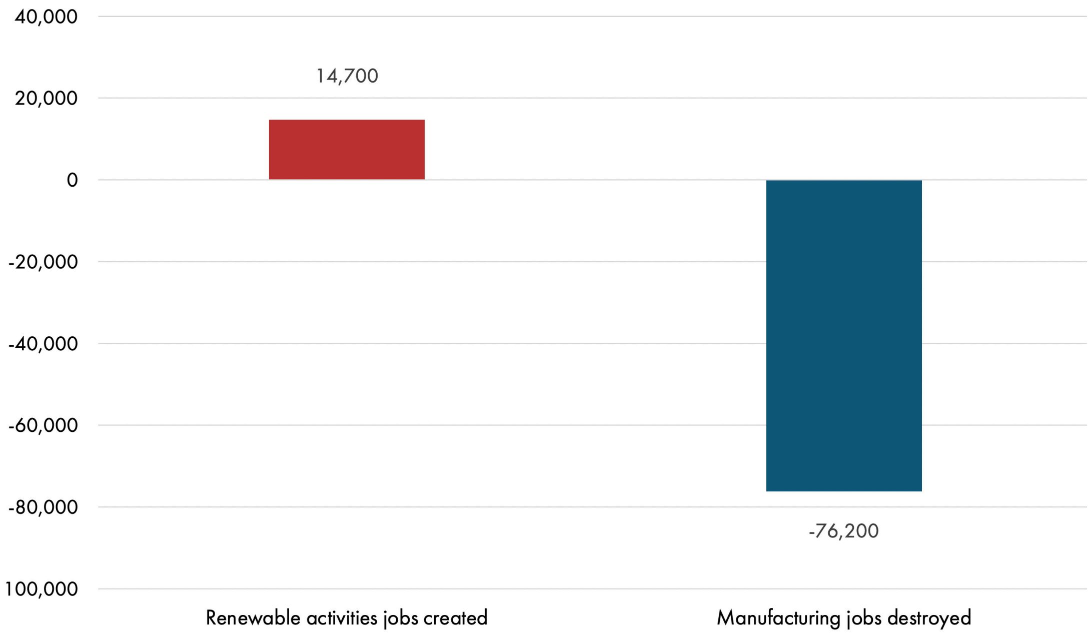
9 The Australian Greens, "Creating the Jobs of the Future: The Greens' Jobs Plan, Election 2019," https://greens.org.au/sites/default/files/2019-05/Greens%202019%20Policy%20Platform%20-Creating%20the%20jobs%20of%20the%20future.pdf.

10 Beyond Zero Emissions, "The Million Jobs Plan," June 2020, https://bze.org.au/wp-content/uploads/2020/11/BZE-The-Million-Jobs-Plan-Full-Report-2020.pdf.

in renewable activities increased by 14,700, but 76,200 manufacturing jobs were destroyed.[11] This means that for every job created in renewable activities over this time, five manufacturing jobs were lost. The period 2009-10 to 2018-19 is used as that is the entire time series available from the Australian Bureau of Statistics.

It is also worth noting that many of the estimates of jobs created under a net zero emissions target would be created directly through government policy and taxpayer support. This indicates that the share of the workforce directly reliant on private sector workers would increase, requiring either higher taxes or fewer government services elsewhere to fund them. By contrast, the industries placed at risk by a net zero emissions target tend to have very high levels of private sector employment, suggesting that these workers are vital contributors to the taxation pool which funds the public sector. For example, 99.6% of jobs in the agriculture, forestry and fishing industry are in the private sector, 100% of mining jobs are in the private sector, and 99.7% of manufacturing jobs are in the private sector.[12]

Chart 3: Job changes between 2009-10 and 2018-19



Source: IPA, ABS.

11 Australian Bureau of Statistics, “Employment in Renewable Energy Activities, Australia, 2018-19 Financial Year,” April 2020, https://www.abs.gov.au/statistics/labour/employment-and-unemployment/employment-renewable-energy-activities-australia/2018-19; Australian Bureau of Statistics, “Labour Force, Australia, Detailed, December 2020,” January 2021, https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia-detailed/dec-2020.

12 Ibid.

Conclusion

The 2019 federal election delivered a clear message to Australia's political class: mainstream Australians care about their livelihoods and are not willing to risk losing their jobs in pursuit of economically and socially devastating emissions reduction policies.

Despite the clear, democratic mandate to maintain a relatively less-destructive emissions policy, the federal government has changed course since its re-election.

In January 2020 Prime Minister Scott Morrison refused to commit to a net zero emissions target, arguing that people who do so "make a glib promise about that and they can't look Australians in the eye and tell them what it will mean for their electricity prices, what it will mean for their jobs."[13]

One year later, the Prime Minister said that the government's "goal is to reach net zero emissions as soon as possible, and preferably by 2050."[14]

Adopting such a target would be devastating for the Australians whose livelihoods will be placed at risk.

As this report has outlined, a net zero emissions target will directly place up to 653,600 jobs at risk. This does not account for indirect job losses as a result of reduced economic activity.

These job losses would place an enormous strain on mainstream Australians, and as outlined in this report, the electorates which will suffer most are disproportionately held by Coalition parties. At the same time, the majority of the seats which are least likely to suffer job losses as a result of a net zero emissions target are also held by the Coalition, which reveals an internal tension within the government.

It is also unlikely that jobs lost as a result of a net zero emissions target will be replaced by 'green' jobs. As this report highlights, between 2009-10 and 2018-19, five manufacturing jobs were destroyed for each renewable activity job created.

A net zero emissions target would destroy communities where there is a high reliance on relatively more energy-intensive jobs. Adopting such a target in the wake of the largest economic contraction and employment crisis in recent memory, caused by COVID-19 and resulting lockdowns, would be devastating for Australian workers.

13 Andrew Tillett and Mark Ludlow, "No net zero emissions target if it hurts jobs: PM," *Australian Financial Review*, 20 January 2020, https://www.afr.com/politics/federal/no-net-zero-emissions-target-if-it-hurts-jobs-pm-20200120-p53t18.

14 Phillip Coorey, "PM inches closer to net zero by 2050," *Australian Financial Review*, 1 February 2021, https://www.afr.com/politics/federal/pm-inches-closer-to-net-zero-by-2050-20210201-p56ybg.

NET ZERO JOBS AN ANALYSIS OF THE EMPLOYMENT IMPACTS OF A NET ZERO EMISSIONS TARGET IN AUSTRALIA

About the Institute of Public Affairs

The Institute of Public Affairs is an independent, non-profit public policy think tank, dedicated to preserving and strengthening the foundations of economic and political freedom.

Since 1943, the IPA has been at the forefront of the political and policy debate, defining the contemporary political landscape.

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The IPA supports the free market of ideas, the free flow of capital, a limited and efficient government, evidence-based public policy, the rule of law, and representative democracy. Throughout human history, these ideas have proven themselves to be the most dynamic, liberating and exciting. Our researchers apply these ideas to the public policy questions which matter today.

About the author

Cian Hussey joined the Institute of Public Affairs as a Research Associate in 2019. He is interested in the impacts of red tape on small businesses and the broader economy. His work at the IPA focuses on using RegData Australia to quantitatively analyse the impacts of regulation. He has published a number of opinion pieces in The Australian, The Daily Telegraph, The West Australian, The Spectator, and regularly appears on Sky News. Cian received a Bachelor of Arts from The University of Notre Dame Australia, majoring in Politics and International Relations.

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Institute of Public Affairs

THE ECONOMIC AND EMPLOYMENT CONSEQUENCES OF NET ZERO EMISSIONS BY 2050 IN AUSTRALIA

April 2022

Daniel Wild
Director of Research, Institute of Public Affairs

Institute of Public Affairs

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Introduction

In the lead up to the 2021 United Nations Climate Change Conference (COP26) held in Glasgow, Scotland from 31 October to 13 November 2021, the Australian government committed to adopting a target of net zero emissions by the year 2050.

Following the conference, the government published *Australia's Long-Term Emissions Reduction Plan: A whole-of-economy plan to achieve net zero emissions by 2050* which outlined the broad policies the government would implement for Australia to meet the net zero by 2050 target.

Modelling published as a part of the plan claims that meeting the net zero emissions target will increase Gross National Income per capita by $2,000 in the year 2050, with the vast majority of the claimed benefit the result of 'advanced technology'.

However, there has been little analysis or discussion of the costs of a net zero emissions by 2050 target in terms of employment or forgone economic output and growth.

In February 2021 the Institute of Public Affairs (IPA) was among the first organisations to provide an estimate of the potential employment impact of a net zero emissions target, with research finding that up to 653,600 existing jobs would be put at risk. The research report, *Net Zero Jobs: An analysis of the employment impact of a net zero emissions by 2050 target,* also identified that the majority of jobs at risk would be in the agriculture, mining, and manufacturing sectors.

Subsequent research by the IPA, *Net Zero Emissions Will Divide Australians: A state-based electoral analysis of the impact of net zero emissions*, identified the inequitable impact of a net zero emissions target, with a worker in a typical electorate represented by the Nationals being more than three times as likely to lose their job as a result of net zero compared with a worker in a typical electorate represented by the Liberal Party. This is because the overwhelming majority of jobs placed at risk by net zero are located in the regions and outer-metropolitan areas of major cities.

Specifically, that research identified that up to 24% of jobs in the electorate of Flynn, 22% of jobs in Maranoa, and 18% of jobs in Capricornia could be put at risk by a net zero emission by 2050 target - all three of which are represented by the Nationals.

This study builds on previous IPA research by analysing the potential economic and employment impact of a ban on all new coal, gas, and oil projects – which at a minimum would be required for Australia to meet its net zero emissions by 2050 commitment.

The cost estimate is based on the investment value of coal, gas, and oil projects which would be prohibited from proceeding as a result of a ban. The data is drawn from Commonwealth Department of Industry, Science, Energy, and Resource's (DISER's) report: *2021 Resources and Energy Major Projects Report,* which categorises resources and energy projects into four categories: 'publicly announced', 'feasibility', 'committed', and 'completed'. The publicly announced stage refers to projects which are 'are usually very early in their development, and are typically undergoing an initial feasibility study to assess the commercial aspects of developing an identified resource'. The feasibility stage refers to the stage of the project development cycle when the 'initial feasibility study for a project has been completed and the results support further development.' The committed stage refers to projects which have 'have completed all commercial, engineering and environmental studies, received all necessary government regulatory approvals, and finalised the financing of the project to allow construction.' And the completed stage refers to projects where construction is completed and the operation has reached commercial production.

A ban on all new coal, gas, and oil projects would affect those projects which are in the publicly announced and feasibility stages, and it is the investment values of these projects as identified in the *2021 Resources and Energy Major Projects Report* which are analysed in this study. In addition, this report also utilises the Australian Bureau of Statistics' (ABS') Input-Output Table to estimate the multiplier effects of the economic output and jobs put at risk by the proposed ban.

The economic multiplier refers to the economic activity which is generated as a result of the flow-on effects from another activity (like a coal project), for example through the creation of more jobs and higher wages which generate more consumer spending.

This is a conservative approach to estimating the potential forgone economic output of a ban on new coal, gas, and oil projects, as it doesn't include projects which are in the committed state. As DISER noted, 'Projects at the committed stage have completed all commercial, engineering and environmental studies, received all necessary government regulatory approvals, and finalised the financing of the project to allow construction. Such projects are considered to have received a positive final investment decision from the owner(s).'

While many of these projects will be constructed, some will not. As the department states, 'Most projects that progress to the committed stage will eventually commence production. Nevertheless, post-final investment decision, there are still technical and financial risks that, if realised, can result in delays, scope changes and cost overruns, or even affect the commercial viability of a project and possibly lead to its cancellation.' Policies such as net zero emissions by 2050, by adding to the potential cost of projects, increase the likelihood that 'committed' projects will later be cancelled.

The approach also only includes projects which are *currently* being considered. However, a permanent ban on all new coal, gas, and oil projects would not just affect projects currently being considered, but all future projects that would otherwise have been considered but would not proceed as a result of the ban.[1]

1 Note: "oil projects" are defined as "LNG and petroleum projects" as per the *2021 Resources and Energy Major Project Report*

Table 1: Summary of economic costs of coal, gas, and oil ban

State/Region	Number of Projects	Cost Estimate[1] ($b)	Total Industrial Output Value[2] ($b)	Annual Regional Product[3] ($b)	Cost as % of Annual Regional Product (%)	Total Project Employment Impact[4] (Persons)	Regional Employed[5] (Persons)	Employment Impact as % of Employed Persons (%)
Australia	89	167.18	273.78	2030	13.49	478,673	13,255,000	3.60
Western Australia	12	75.41	114.76	320.65	35.79	186,276	1,452,061	12.78
Queensland	45	68.30	119.61	368.98	32.42	221,916	2,647,000	8.38
North Qld	23	37.46	66.58	75.88	87.74	125,005	347,948	35.93
Central Qld	13	10.81	19.38	22.69	85.41	36,656	115,261	31.80
South-West Qld	9	20.02	33.65	20.77	162.01	60,154	135,306	44.50
New South Wales	21	13.70	23.52	633.64	3.71	42,899	4,094,693	1.05
Hunter	15	6.43	11.50	59.31	20.30	21,789	324,012	6.72
Other NSW	6	7.02	11.62	592.94	1.96	21,110	3,770,681	0.54
Other States/ Territories	11	9.78	15.89	643.45	2.47	27,532	4,712,000	0.58

Notes
1 DISER Report, mid value estimate used when cost range provided.
2 ABS, Australian National Accounts: Input-Output Tables 2018-19, ABS 5209.0.55.001. Simple output multiplier effect.
3 REMPLAN, Gross regional product by Statistical Area Level 4, 2020-21.
4 NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3. Simple multiplier effect and type 2 consumption effect.
5 ABS, Labour Force, detailed, Australia 6291.0.55.001, 6291.0.55.003.

As summarised in Table 1, the economic cost of a ban on all new coal, gas, and oil projects is immense. The total cost across Australia is estimated to be $273.78 billion in terms of forgone economic output, which is equivalent to 13.5% of annual GDP. This corresponds with an estimated 478,673 forgone jobs, equating to approximately 3.6% of Australia's total workforce.

Detailed analysis was undertaken of the impact of a ban on all new coal, gas, and oil projects by regions that would host the vast majority of those projects. Specifically, the costs would be as follows:

- *North Queensland:* $66.58 billion in foregone economic output which is the equivalent to 87.74% of annual gross regional product. This will prevent the creation of approximately 125,000 jobs, which is the equivalent to around 35.9% of the current local workforce. This is the equivalent to 25 years' worth of job creation.
- *Central Queensland:* $19.38 billion in foregone economic output which is the equivalent to 85.4% of annual gross regional product. This will prevent the creation of approximately 36,650 jobs which is the equivalent to around 31.8% of the current local workforce. This is the equivalent to 18 years' worth of job creation.

- *South-West Queensland:* $33.65 billion in foregone economic output which is the equivalent to 162% of annual gross regional product. This will prevent the creation of approximately 60,154 jobs which is equivalent to around 44.5% of the current local workforce. This is the equivalent to over 50 years' worth of job creation.
- *Hunter-Newcastle:* $11.5 billion in foregone economic output which is the equivalent to 20% of annual gross regional product. This will prevent the creation of approximately 21,800 jobs which is the equivalent to around 6.7% of the current local workforce. This is the equivalent to 4 years' worth of job creation.

The geographic definition of regions is taken from the ABS statistical-area 4 delineations. North Queensland is defined as the regional towns of MacKay (which includes Mackay, Isaac, and Whitsunday), Townsville, and Cairns. Central Queensland takes in the regional towns Rockhampton, Gladstone, and Emerald. South-West Queensland takes in the Darling Downs-Maranoa region (which includes Warwick, Dalby, St. George, and Roma) as well as Toowoomba. And Hunter-Newcastle takes in the Newcastle and Lake Macquarie region.

Analysis was also undertaken of the economic impact of a ban on new coal, gas, and oil projects on the three major resources states: Western Australia, Queensland, and New South Wales (NSW). The estimated costs to these states are as follows:

- *Western Australia:* $114.76 billion in foregone economic output which is the equivalent to 35.8% of annual gross state product. This will prevent the creation of 186,000 jobs which is the equivalent to around 12.8% of Western Australia's current workforce. This is the equivalent to 8.5 years' worth of job creation.
- *Queensland:* $119.61 billion in foregone economic output which is the equivalent to 32.4% of annual gross state product. This will prevent the creation of around 221,900 jobs which is the equivalent to around 8.4% of Queensland's current workforce. This is the equivalent to almost 5 years' worth of job creation.
- *NSW:* $23.52 billion in foregone economic output which is the equivalent to 3.7% of annual gross state product. This will prevent the creation of around 42,900 jobs which is the equivalent to around 1% of NSW's workforce. This is the equivalent to almost a year's worth of job creation.

The economic impact of a ban on new coal, gas, and oil projects across Australia

This study utilises data provided by DISER's *2021 Resources and Energy Major Projects Report*, which provides the estimated investment values of key projects included in the study. It also utilises the ABS' Input-Output Table to estimate the multiplier effects of the economic output and jobs put at risk by the proposed ban. As noted in the introduction, the department classifies projects as being in one of four stages: 'publicly announced', 'feasibility', 'committed', and 'completed'. Only projects which are in the publicly announced and feasibility stages are considered in this report.

The *2021 Resources and Energy Major Projects Report* details 89 oil, gas, and coal projects currently in the publicly announced and feasibility stages valued at approximately $167 billion.[2]

Table 2: Coal, gas, and oil projects in Australia in 'publicly announced' and 'feasibility' stages

Publicly Announced and Feasibility Stage Projects	NSW		VIC		QLD		SA	
	Number	Value A$m	Number	Value A$m	Number	Value A$m	Number	Value A$m
Coal	19	$9,849	0	$0	40	$57,866	1	$3,750
LNG, Gas, Petroleum	2	$3,850	7	$1,575	5	$10,425	1	$200
Total	21	$13,699	7	$1,575	45	$68,291	2	$3,950

Publicly Announced and Feasibility Stage Projects	WA		TAS		NT		Total National Projects at Risk	
	Number	Value A$m	Number	Value A$m	Number	Value A$m	Number	Value A$m
Coal	0	$0	0	$0	0	$0	60	$71,465
LNG, Gas, Petroleum	12	$75,412	1	$500	1	$3,750	29	$95,712
Total	12	$75,412	1	$500	1	$3,750	89	$167,177

Data soured from 2021 Resources and Energy Major Projects Report published by DISER.
Mid value is used in calculations where a range is provided in the report.

While thermal coal production remains more controversial than metallurgical coal production - given its perceived contribution to greenhouse gas emissions, particularly carbon dioxide - it is important to clarify that many of the coal projects in the pipeline intend to produce both thermal and metallurgical coal.

The potential investments in coal, gas and petroleum projects all across the nation total $167 billion. But an analysis of the supply and use of goods and services as well as inter-industry flows in the economy suggests a more considerable economic impact. A detailed analysis using simple multipliers derived from the ABS' Input – Output Tables for the Australian economy in 2018-19 estimates the contribution of these investments, including the intermediate transactions and supply linkages between various product

2 Australian Government DISER, 2021, *Resources and Energy Major Projects: 2021*. Available https://www.industry.gov.au/data-and-publications/resources-and-energy-major-projects-2021

categories, to be almost $274 billion in national output excluding taxes. This is equivalent to around 13.5% of Australia's Gross Domestic Product.[3,4]

Table 3: Economic impact of ban on new coal, gas, and oil projects

Resource	Sub-industry	Initial Effect (1)	First-round Effect Multiplier (2)	Output Multipliers Industrial Support Effect (3)	Production-induced effect (4) = (2)+(3)	Simple Multiplier (5)=(1)+(2)+(3)
Coal	Coal Mining	1.00	0.37	0.42	0.79	1.79
LNG, Gas, Petroleum	Oil and gas extraction	1.00	0.26	0.26	0.52	1.52
Resource	**A$m Value of Publicly Announced and Feasibility Stage Projects**	**Initial Effect (1)**	**First-round Effect Multiplier (2)**	**Output Multipliers Industrial Support Effect (3)**	**Production-induced effect (4) = (2)+(3)**	**Simple Multiplier (5)=(1)+(2)+(3)**
Coal	$71,465	$71,465	$26,396	$30,269	$56,665	$128,130
LNG, Gas, Petroleum	$95,712	$95,712	$24,646	$25,294	$49,940	$145,652
Total Contribution to National output	$167,177	$167,177	$51,042	$55,563	$106,605	$273,782

Source: ABS, Australian National Accounts: Input-Output Tables 2018-19, ABS 5209.0.55.001.
The output multipliers are derived from the ABS Input-Output Tables of the Australian Economy
The initial effect (1) describes relative labour-intensity of the industry.
The first-round effect multiplier (2) and the industrial support effect (3) describes the relationship between intermediate cross-industry inputs and final industry outputs.
The first-round effect and the industrial support effect (3) together give the production-induced multiplier (4).
The initial effect and the production-induced multiplier represent the simple employment multiplier (5).

An analysis using the NSW Treasury Employment Calculator, which derives employment multipliers from the ABS Input-Output Tables, shows the $167 billion in investment projects is estimated to produce around 294,817 full-time equivalent (FTE) positions comprising 98,328 direct jobs and a further 196,489 indirect jobs from backward linkages of intermediate cross-industry inputs as well as industry support.[5]

The modelling also shows that 183,856 jobs are estimated to be generated from household consumption expenditure resulting in a total of 478,673 new jobs foregone if a ban on new coal, gas and oil projects were implemented.

3 ABS, 2021, *Australian National Accounts, Input-Output Tables, 2018-19.* Available https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-input-output-tables

4 ABS, 2022, *Australian National Accounts: National Income, Expenditure and Product.* Available https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-national-income-expenditure-and-product/latest-release#data-download

5 NSW Treasury, 2020, *AUS Input-Output Employment Multipliers.* Available https://www.treasury.nsw.gov.au/sites/default/files/2020-10/AUS%20IO%20Model%2013102020.xlsx

Table 4: Employment Impact of a ban on new coal, gas, and oil projects

Resource	Sub-industry	Initial Effect (1)	First-round Effect Multiplier (2)	Output Multipliers Industrial Support Effect (3)	Production-induced effect (4)=(2)+(3)	Simple Multiplier (5)=(1)+(2)+(3)	Consumption Multiplier (6)	Total Employment Multiplier (7)=(5)+(6)
Coal	Coal Mining	0.80	0.79	0.58	1.37	2.17	1.22	3.39
LNG, Gas, Petroleum	Oil and gas extraction	0.43	0.52	0.51	1.03	1.46	1.01	2.47
Resource	**A$m Value of Publicly Announced and Feasibility Stage Projects**	**Initial Effect (1)**	**First-round Effect Multiplier (2)**	**Output Multipliers Industrial Support Effect (3)**	**Production-induced effect (4)=(2)+(3)**	**Simple Multiplier (5)=(1)+(2)+(3)**	**Consumption Multiplier (6)**	**Total Employment Multiplier (7)=(5)+(6)**
Coal	$71,465	57,172	56,457	41,449	97,906	155,078	87,187	242,265
LNG, Gas, Petroleum	$95,712	41,156	49,770	48,813	98,583	139,739	96,669	236,408
Total FTE Jobs	**$167,177**	**98,328**	**106,227**	**90,262**	**196,489**	**294,817**	**183,856**	**478,673**

Source: NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3.

State and regional economic impact of a ban on new coal, gas, and oil projects

The states where planned investments are most at risk from a ban on coal, gas, and oil projects are Queensland, Western Australia, and NSW.

Queensland has 40 coal projects in the publicly announced and feasibility stages valued at $57.87 billion and 5 oil and gas projects worth $10.43 billion.

Employment associated with the investment projects planned in Queensland includes around 46,300 direct and 79,300 indirect jobs in the coal industry as well as 4,500 direct and 10,700 indirect jobs in the oil and gas industries. Together, this totals around 140,800 FTE positions across the whole sector.

Furthermore, household consumption expenditures generated by these projects in Queensland can be expected to generate an additional 70,600 jobs economy-wide from the coal projects and 10,500 from the oil and gas projects, resulting in a total of approximately 221,900 FTE jobs representing around 8.4% of Queensland's entire labour force.

Table 5: Employment of a ban on new coal, gas, and oil projects in Queensland

Resource	Sub-industry	Initial Effect (1)	First-round Effect Multiplier (2)	Output Multipliers Industrial Support Effect (3)	Production-induced effect (4)=(2)+(3)	Simple Multiplier (5)=(1)+(2)+(3)	Consumption Multiplier (6)	Total Employment Multiplier (7)=(5)+(6)
Coal	Coal Mining	0.80	0.79	0.58	1.37	2.17	1.22	3.39
LNG, Gas, Petroleum	Oil and gas extraction	0.43	0.52	0.51	1.03	1.46	1.01	2.47
Resource	**A$m Value of Publicly Announced and Feasibility Stage Projects**	**Initial Effect (1)**	**First-round Effect Multiplier (2)**	**Output Multipliers Industrial Support Effect (3)**	**Production-induced effect (4)=(2)+(3)**	**Simple Multiplier (5)=(1)+(2)+(3)**	**Consumption Multiplier (6)**	**Total Employment Multiplier (7)=(5)+(6)**
Coal	$57,870	46,293	45,714	33,562	79,276	125,569	70,597	196,166
LNG, Gas, Petroleum	$10,425	4,483	5,421	5,317	10,738	15,221	10,529	25,750
Total FTE Jobs	**$68,295**	**50,776**	**51,135**	**38,879**	**90,014**	**140,790**	**81,126**	**221,916**

Source: NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3.

A breakdown of the coal, oil, and gas projects tabled in the DISER report shows there are 20 coal projects in the publicly announced and feasibility stages in Queensland's northern region which represents half of all coal projects in the state. The estimated $35.33 billion of investments are associated with 119,775 FTE jobs when consumption expenditures are included. There are also 3 gas projects in the northern region worth an estimated $2.13 billion, which is associated with 5,228 FTE jobs. The combined coal, oil and gas projects in northern Queensland are associated with 125,000 FTE jobs (35.9% of total regional jobs).

In Central Queensland, there are 13 coal projects in the publicly announced and feasibility stages worth an estimated $10.81 billion associated with 36,650 FTE positions which is equivalent to 31.8% of jobs in the SA4 region.

There are 7 coal projects in the pipeline in South-West Queensland worth $11.72 billion which are associated with 39,736 jobs across the Darling Downs, Maranoa and Toowoomba regions. There are also 2 oil and gas projects worth $8.3 billion associated with 20,418 FTE jobs.

Together, the $20 billion in coal, oil, and gas projects would attract approximately 60,150 jobs, representing 44.5% of total employed persons across the South-West Queensland region.

Table 6: Economic cost of ban on new coal, gas, and oil projects in Queensland

Queensland Coal, Oil and Gas Projects	Project	Location		Region	Cost Estimate (A$m)	GVA Produced (A$m)
Thermal coal	Alpha (mine and rail	120 km SW of Clermont	Feasibility	Northern	$10,800	$19,363
Thermal and metallurgical coal	Caval Ridge Mine Horse Pit Extension	155 km SW of Mackay	Publicly announced	Northern	$1,000	$1,793
Metallurgical coal	Codrilla	62 km SE of Moranbah	Publicly announced	Northern	$750	$1,344
Metallurgical coal	Colton	11 km N of Maryborough	Publicly announced	Northern	$375	$671
Metallurgical coal	Dysart East	5 km NE of Dysart	Feasibility	Northern	$200	$359
Thermal coal	Galilee Coal Project (formerly China First)	36 km NE of Jericho	Feasibility	Northern	$6,400	$11,475
Metallurgical coal	Grosvener Phase 2	4 k m SE of Moranbah	Feasibility	Northern	$125	$223
Thermal and metallurgical coal	Ironbank No. 1	35 km NE of Moranbah	Feasibility	Northern	$125	$223
Thermal coal	Kevin's Corner	Galilee Basin	Feasibility	Northern	$5,200	$9,323
Metallurgical coal	Lake Vermont Extension	160 km SW of Mackay	Publicly announced	Northern	$100	$179
Thermal coal	Moorlands	25 km W of Clermont	Publicly announced	Northern	$148	$265
Metallurgical coal	Moranbah South	10 km SE of Moranbah	Feasibility	Northern	$2,000	$3,586
Thermal and metallurgical coal	New Lenton	20 km E of Moranbah	Feasibility	Northern	$375	$671
Metallurgical coal	Olive Downs (Phase 2)	25 km S of Coppabella	Feasibility	Northern	$587	$1,052
Metallurgical coal	Red Hill Mining	20 km N of Moranbah	Feasibility	Northern	$1,250	$2,240
Metallurgical coal	Saraji East	30 km N of Dysart	Publicly announced	Northern	$2,400	$4,303
Thermal and metallurgical coal	Talwood	35 km N of Moranbah	Publicly announced	Northern	$700	$1,255
Metallurgical coal	Wards Well	29 km SW of Glenden	Feasibility	Northern	$1,500	$2,689
Thermal and metallurgical coal	Willunga/ Vermont East	75 km NE of Clermont	Feasibility	Northern	$300	$538
Metallurgical coal	Winchester South	150 km SW of Mackay	Feasibility	Northern	$1,000	$1,793

Gas	Bowen Gas Project	150 km SW of Mackay	Publicly announced	Northern	$500	$761
Gas	Glenaras Gas Project	Galilee Basin	Publicly announced	Northern	$1,500	$2,283
Gas /LNG	Mahalo Gas Project	Bowen Basin	Publicly announced	Northern	$125	$190
Northern Regions Total					$37,460	$66,579
Thermal and metallurgical coal	Belview	10 km E of Blackwater	Publicly announced	Central	$907	$1,626
Metallurgical coal	Wilton-Fairhill	70 km NW of Blackwater	Feasibility	Central	$375	$671
Metallurgical coal	Washpool	60 km NE of Emerald	Feasibility	Central	$368	$660
Thermal and metallurgical coal	Valeria	27 km NW of Emerald	Feasibility	Central	$1,500	$2,689
Metallurgical coal	Walton	20 km E of Bluff	Feasibility	Central	$125	$223
Thermal coal	Taroborah	22 km W of Emerald	Feasibility	Central	$560	$1,004
Thermal and metallurgical coal	Teresa	17 km N of Emerald	Feasibility	Central	$375	$671
Thermal coal	South Galilee	160 km W of Emerald	Feasibility	Central	$4,200	$7,530
Thermal coal	Springsure Creek	40 km S of Emerald	Feasibility	Central	$1,250	$2,240
Thermal and metallurgical coal	Styx (Central Queensland Coal)	139 km NW of Rockhampton	Feasibility	Central	$240	$430
Thermal coal	Rolleston (phase 2)	16 km W of Rolleston	Feasibility	Central	$400	$717
Thermal coal	Minyango	3 km S of Blackwater	Publicly announced	Central	$390	$699
Thermal and metallurgical coal	Comet Ridge	20 km S of Comet	Feasibility	Central	$125	$223
Central Regions Total					$10,815	$19,383
Thermal coal	The Range	24 km SE of Wandoan	Feasibility	South-West	$780	$1,398
Thermal coal	Wandoan	60 km N of Miles	Publicly announced	South-West	$7,000	$12,550
Thermal coal	Elimatta	45 km SW of Taroom	Feasibility	South-West	$750	$1,344
Thermal coal	New Acland (Stage 3 extension)	177 km W of Brisbane	Feasibility	South-West	$900	$1,614
Thermal coal	North Surat - Collingwood	12 km NE of Wandoan	Publicly announced	South-West	$652	$1,169
Thermal coal	North Surat - Taroom	3 km SE of Taroom	Publicly announced	South-West	$1,120	$2,008
Thermal coal	North Surat - Woori	19 km S of Wandoan	Publicly announced	South-West	$520	$932
Gas	Surat Gas Project (Phases 2-5)	160 km W of Brisbane	Feasibility	South-West	$8,000	$12,174
Gas	Tipton	30 km west Dalby, Surat Basin	Feasibility	South-West	$300	$457
Southern Regions Total					$20,022	$33,646

Source: 2021 Resources and Energy Major Projects Report published by DISER.
ABS, Australian National Accounts: Input-Output Tables 2018-19, ABS 5209.0.55.001.
NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3.

Western Australia has 12 oil and gas projects in the publicly announced and feasibility stages worth around $75.41 billion. Industry employment associated with Western Australia's planned oil and gas projects is estimated to be around 110,100 FTE jobs comprising 32,430 direct and 76,670 indirect jobs, with household consumption expenditures expected to generate an additional 76,170 jobs across the broader economy - taking the total to approximately 186,500 FTE positions.

Table 7: Employment impact of ban on new coal, gas, and oil projects in Western Australia

Resource	Sub-industry	Initial Effect (1)	First-round Effect Multiplier (2)	Output Multipliers Industrial Support Effect (3)	Production-induced effect (4)=(2)+(3)	Simple Multiplier (5)=(1)+(2)+(3)	Consumption Multiplier (6)	Total Employment Multiplier (7)=(5)+(6)
Coal	Coal Mining	0.80	0.79	0.58	1.37	2.17	1.22	3.39
LNG, Gas, Petroleum	Oil and gas extraction	0.43	0.52	0.51	1.03	1.46	1.01	2.47
Resource	A$m Value of Publicly Announced and Feasibility Stage Projects	Initial Effect (1)	First-round Effect Multiplier (2)	Output Multipliers Industrial Support Effect (3)	Production-induced effect (4)=(2)+(3)	Simple Multiplier (5)=(1)+(2)+(3)	Consumption Multiplier (6)	Total Employment Multiplier (7)=(5)+(6)
Coal	$0	-	-	-	-	-	-	-
LNG, Gas, Petroleum	$75,412	32,427	39,214	38,460	77,674	110,101	76,166	186,267
Total FTE Jobs	**$75,412**	**32,427**	**39,214**	**38,460**	**77,674**	**110,101**	**76,166**	**186,267**

NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3.

Table 8: Economic Cost of ban on new coal, gas, and oil projects in Western Australia

West Australia LNG, Oil and Gas Projects	Project	Location		Cost Estimate (A$m)	GVA Produced (A$m)
Gas/LNG/condensate/LPG	Browse to North West Shelf	Browse Basin	Feasibility	$30,000	$45,653
Oil	Buffalo	Bonaparte Basin	Publicly Announced	$53	$81
LNG	Cash Maple Development	Timor Sea	Publicly Announced	$10,000	$15,218
LNG	Clio-Acme	Browse Basin	Publicly Announced	$3,800	$5,783
LNG	Crux LNG	700 km W of Darwin	Feasibility	$3,750	$5,707
Oil	Dorado	Carnarvon Basin	Feasibility	$3,750	$5,707
Gas/LNG/condensate	Equus	200 km NW Onslow, WA	Publicly Announced	$6,000	$9,131
LNG	Pluto Expansion (Train 2)	190 km NW of Karratha	Feasibility	$8,400	$12,783
OIl	Pyrenees Infill (Phase 4)	Northern Carnarvon Basin	Publicly Announced	$334	$508

Gas/LNG	Scarborough	220 km NW of Exmouth	Feasibility	$7,600	$11,565
Gas/LNG	Transborders Energy's Generic FLNG Solution	n/a	Feasibility	$1,600	$2,435
Gas	West Erregulia (Phase 1)	Perth Basin	Feasibility	$125	$190
Total WA				$75,412	$114,761

Source: 2021 Resources and Energy Major Projects Report published by DISER.
ABS, Australian National Accounts: Input-Output Tables 2018-19, ABS 5209.0.55.001.
NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3.

NSW has 19 coal projects in the publicly announced and feasibility stages worth around $9.85 billion as well as 2 oil and gas projects worth around $3.85 billion. Industry employment associated with NSW's planned coal, oil and gas projects is estimated to be around 42,900, comprising 9,540 direct and 17,460 indirect jobs, with household consumption expenditures expected to generate an additional 15,900 jobs across the broader economy.

Table 9: Employment impact of ban on new coal, gas, and oil projects in NSW

Resource	Sub-industry	Initial Effect (1)	First-round Effect Multiplier (2)	Output Multipliers Industrial Support Effect (3)	Production-induced effect (4)=(2)+(3)	Simple Multiplier (5)=(1)+(2)+(3)	Consumption Multiplier (6)	Total Employment Multiplier (7)=(5)+(6)
Coal	Coal Mining	0.80	0.79	0.58	1.37	2.17	1.22	3.39
LNG, Gas, Petroleum	Oil and gas extraction	0.43	0.52	0.51	1.03	1.46	1.01	2.47
Resource	**A$m Value of Publicly Announced and Feasibility Stage Projects**	**Initial Effect (1)**	**First-round Effect Multiplier (2)**	**Output Multipliers Industrial Support Effect (3)**	**Production-induced effect (4)=(2)+(3)**	**Simple Multiplier (5)=(1)+(2)+(3)**	**Consumption Multiplier (6)**	**Total Employment Multiplier (7)=(5)+(6)**
Coal	$9,849	7,879	7,781	5,712	13,493	21,372	12,016	33,388
LNG, Gas, Petroleum	$3,850	1,656	2,002	1,964	3,966	5,622	3,889	9,511
Total FTE Jobs	**$13,699**	**9,535**	**9,783**	**7,676**	**17,459**	**26,994**	**15,905**	**42,899**

Investments in NSW's Hunter region are expected to produce a total of 21,789 jobs representing 6.7% of the total labour force of the Hunter and Newcastle SA4 regions. The $11.5 billion total industrial output value of proposed projects in the regions is equivalent to 20% of the combined $59.31 billion of gross regional product.

Table 10: Economic Cost of ban on new coal, gas, and oil projects in NSW

NSW Coal Projects	Project	Location		Region	Cost Estimate (A$m)	GVA Produced (A$m)
Metallurgical Coal	Ashton South East opencut	14 km NW of Singleton	Feasibility	Upper Hunter Region	$125	$223
Thermal and Metallurgical Coal	Bulga Optimisation Project mod 3	15 km SW of Singleton	Feasibility	Upper Hunter Region	$657	$1,178
Thermal Coal	Dartbrook	6 km NW of Muswellbrook	Publicly Announced	Upper Hunter Region	$750	$1,344
Thermal and Metallurgical Coal	Glendell Continued Operations	20 km N of Singleton	Feasibility	Upper Hunter Region	$125	$223
Thermal Coal	Mangoola Continued Operations	20 km W of Muswellbrook	Publicly Announced	Upper Hunter Region	$150	$269
Metallurgical Coal	Maxwell Underground Mine	15 km SW of Muswellbrook	Publicly Announced	Upper Hunter Region	$509	$913
Thermal Coal	Mt Pleasant Optimisation Project	3 km NW of Muswellbrook	Feasibility	Upper Hunter Region	$750	$1,344
Thermal and Metallurgical Coal	Spur Hill	15 km SW of Muswellbrook	Feasibility	Upper Hunter Region	$750	$1,344
Thermal Coal	Chain Valley Extension	40 km S of Newcastle	Publicly Announced	Hunter Region	$125	$223
Thermal and Metallurgical Coal	HVO Continuation	90 km NW of Newcastle	Publicly Announced	Hunter Region	$500	$896
Thermal and Metallurgical Coal	Mt Arthur	105 km NW of Newcastle	Publicly Announced	Hunter Region	$750	$1,344
Thermal and Metallurgical Coal	Mt Thorley	73 km NW of Newcastle	Feasibility	Hunter Region	$125	$223
Thermal and Metallurgical Coal	Newstan Mine Extension	20 km SW of Newcastle	Publicly Announced	Hunter Region	$170	$305
Thermal Coal	Wallarah 2	30 km SW of Newcastle	Feasibility	Hunter Region	$945	$1,694
Hunter Region Total					$6,431	$11,523
Thermal and Metallurgical Coal	Narrabri (Stage 3)	70 km W of Gunnedah	Feasibility	North West Slopes	$1,250	$2,240
Thermal and Metallurgical Coal	Vickery	22 km N of Gunnedah	Feasibility	North West Slopes	$700	$1,255
Thermal and Metallurgical Coal	Boggabri Coal Extension	Gunnedah	Publicly Announced	North West Slopes	$513	$920
Thermal and Metallurgical Coal	Dendrobium Extension	13 km SW of Wollongong	Feasibility	Illawara	$750	$1,344
Thermal Coal	Angus Place West	15 km NW of Lithgow	Publicly Announced	Central Tablelands	$210	$377
Other Regions Total					$3,423	$6,136
NSW Gas Projects						
Gas	LMG import terminal - Newcastle GasDock	Newcastle	Feasibility	Hunter Region	$250	$380
Gas	Narrabri coal steam gas project	Narrabri	Feasibility	North West Slopes	$3,600	$5,478
All Regions Total					$3,850	$5,858
All NSW Projects Total					$13,704	$23,517

Source: 2021 Resources and Energy Major Projects Report published by DISER.
ABS, Australian National Accounts: Input-Output Tables 2018-19, ABS 5209.0.55.001.
NSW Treasury Employment Calculator, NSW Treasury analysis based on ABS 5209.0, 5246.0, TPP09-7 and TRP09-3.

Conclusion

The economic consequences of a ban on new coal, gas, and oil projects in Australia would be immense, with the total cost across Australia estimated at approximately $274 billion, which is the equivalent to 13.5% of Australia's annual GDP. This corresponds to an estimated 478,673 jobs put at risk, equating to approximately 3.6% of Australia's total workforce.

The impact of a ban on new coal, gas, and oil projects would be most heavily concentrated in the major resources states of Queensland, Western Australian, and NSW - especially in the northern, central, and south-western parts of Queensland as well as NSW's Hunter region. Specifically, the economic and job implications are as follows:

- *North Queensland:* $66.58 billion in foregone economic output which is the equivalent to 87.74% of annual gross regional product. This will prevent the creation of approximately 125,000 jobs, which is the equivalent to around 35.9% of the current local workforce. This is the equivalent to 25 years' worth of job creation.
- *Central Queensland:* $19.38 billion in foregone economic output which is the equivalent to 85.4% of annual gross regional product. This will prevent the creation of approximately 36,650 jobs which is the equivalent to around 31.8% of the current local workforce. This is the equivalent to 18 years' worth of job creation.
- *South-West Queensland:* $33.65 billion in foregone economic output which is the equivalent to 162% of annual gross regional product. This will prevent the creation of approximately 60,154 jobs which is equivalent to around 44.5% of the current local workforce. This is the equivalent to over 50 years' worth of job creation.
- *Hunter-Newcastle:* $11.5 billion in foregone economic output which is the equivalent to 20% of annual gross regional product. This will prevent the creation of approximately 21,800 jobs which is the equivalent to around 6.7% of the current local workforce. This is the equivalent to 4 years' worth of job creation.

Analysis was also undertaken of the economic impact of a ban on new coal, gas, and oil projects on the three major resources states: Western Australia, Queensland, and NSW. The cost estimates are as follows:

- *Western Australia:* $114.76 billion in foregone economic output which is the equivalent to 35.8% of annual gross state product. This will prevent the creation of 186,000 jobs which is the equivalent to around 12.8% of Western Australia's current workforce. This is the equivalent to 8.5 years' worth of job creation.
- *Queensland:* $119.61 billion economic in foregone economic output which is the equivalent to 32.4% of annual gross state product. This will prevent the creation of around 221,900 jobs which is the equivalent to around 8.4% of Queensland's current workforce. This is the equivalent to almost 5 years' worth of job creation.
- *NSW:* $23.52 billion in foregone economic output which is the equivalent to 3.7% of annual gross state product. This will prevent the creation of around 42,900 jobs which is the equivalent to around 1% of NSW's workforce. This is the equivalent to almost a years' worth of job creation.

THE ECONOMIC AND EMPLOYMENT CONSEQUENCES OF NET ZERO EMISSIONS BY 2050 IN AUSTRALIA

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The Institute of Public Affairs is an independent, non-profit public policy think tank, dedicated to preserving and strengthening the foundations of economic and political freedom. Since 1943, the IPA has been at the forefront of the political and policy debate, defining the contemporary political landscape. The IPA is funded by individual memberships and subscriptions, as well as philanthropic and corporate donors. The IPA supports the free market of ideas, the free flow of capital, a limited and efficient government, evidence-based public policy, the rule of law, and representative democracy.

Throughout human history, these ideas have proven themselves to be the most dynamic, liberating and exciting. Our researchers apply these ideas to the public policy questions which matter today.

About the author

Daniel Wild is the Director of Research at the Institute of Public Affairs. He specialises in red tape, regulation, economic policy, the philosophy of free enterprise, and criminal justice. Daniel has authored research papers on economic policy, environmental regulation, and criminal justice reform. Daniel frequently appears in the media, and has published a number of opinion pieces in The Australian, The Daily Telegraph, The Sydney Morning Herald, The Courier Mail, and The Spectator. Daniel has also made a number of radio and television appearances, including on 2GB, 3AW, Sky News, and Channel 7 News. Daniel previously worked at the Commonwealth Department of the Prime Minister and Cabinet where he analysed global and domestic macroeconomic policy. Prior to that he worked at the Commonwealth Department of Finance where he worked on regulatory reform. Daniel holds an honours qualification in economics and a degree in international studies from the University of Adelaide.

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AUSTRALIA'S NET ZERO ENERGY CRISIS

AN ANALYSIS OF THE ELECTRICITY PRICE IMPLICATIONS OF NET ZERO EMISSIONS BY 2050

June 2022

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Daniel Wild, Director of Research

Institute of Public Affairs

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Introduction

The policy of net zero emissions by 2050 presents a significant risk to job growth, economic development, and Australia's energy reliability and affordability.

In April, the Institute of Public Affairs published a landmark study, *The Economic and Employment Consequences of Net Zero Emissions by 2050*, which identifies that to reach net zero emissions by 2050, at a minimum, all 89 coal, gas and oil projects currently in the construction pipeline must be cancelled. It was estimated that this could come at a cost of approximately $274 billion in lost economic output over the next decade and prevent the creation of approximately 478,000 jobs, the majority of which would be in regional Australia.

The significant economic and humanitarian consequences of the policy of net zero emissions by 2050 are already materialising. Net zero is directly responsible for "the rapidly changing conditions in the National Electricity Market" cited by Origin Energy as the reason for the early closure of the Eraring coal-fired power station,[1] Australia's largest electricity provider which is responsible for more than 20% of New South Wales' electricity production.[2]

A more recent report published by the IPA in May 2022, *The Employment Consequences of the Early Closure of the Eraring Power Station,* identifies that job losses from the early closure of Eraring are likely to be at least 40% higher than the originally expected 1,000-job lay-offs in the Hunter Valley region. Moreover, the overwhelming majority of jobs lost will be permanent, full-time, high-paying positions, which are characteristic of jobs in coal mines and coal-fired power generation facilities.

But the consequences of the closure of Eraring as well as the closures of other coal-fired generators will be more widespread.

Under the policy of net zero emission by 2050, six coal-fired power stations are set to close in Australia by 2030. The capacities of these six facilities account for close to half of the total coal-based capacity of the NEM. They also account for over 20 per cent of the total energy capacity of the NEM. The coal-fired power stations due to close are: Yallourn W, Eraring, Bayswater, Liddell, Vales Point B and Callide B.

The purpose of this report is to estimate the impacts that the closures of these six coal-fired power stations could have on wholesale and retail electricity prices by 2030.

To do this, the report undertakes a quantitative event analysis on the wholesale price implications of the closures of the ten coal-fired power generators decommissioned from 2010 to 2020. This is achieved by measuring the average national wholesale electricity price changes in the quarters immediately before and after the closures

1 Origin Energy (2022, February 17) *Origin proposes to accelerate exit from coal-fired generation,* Origin Energy, https://www.originenergy.com.au/about/investors-media/origin-proposes-to-accelerate-exit-from-coal-fired-generation/

2 Eraring is the largest coal-fired power station in Australia if Loy Yang A and Loy Yang B are counted as separate stations.

of the power stations. The results are then extrapolated to provide an estimate of the potential price impact of the closures of the six coal-fired power stations set for decomissioning by 2030. A detailed explanation of the methodology is provided in the body of the report.

Our research estimates that the closures of the six coal-fired generation facilities set to be decommissioned by 2030, in the absence of equivalent replacements in the electricity grid, could result in a 310% increase in wholesale electricity prices by 2030. Since the wholesale component makes up approximately one-third of retail electricity costs, this translates to a 103% increase in retail electricity prices.

This means that a typical Australian family will see its electricity bill more than double as a result of the closures of the six coal-fired power stations under the policy of net zero emissions by 2050.

The average annual electricity bill for a typical Australian family is approximately $1,600 per year, which is $400 per quarter. An increase of 103% translates into an average annual increase of $1,648, which would see the average annual electricity bill increase to approximately $3,248 per year which is $812 per quarter. The figures by states are as follows:

- Queensland families face the prospect of a 110% increase in retail electricity bills, rising from $1,200 to around $2,500 p.a.
- NSW families face the prospect of a 100% increase in retail electricity bills, rising from $1,300 to around $2,600 p.a.
- Victorian families face the prospect of a 95% increase in retail electricity bills, rising from $1,300 to around $2,500 p.a.
- South Australian families face the prospect of a 90% increase in retail electricity bills, rising from $1,700 to around $3,200 p.a.
- Tasmanian families face the prospect of a 125% increase in retail electricity bills, rising from $2,000 to around $4,500 p.a.

In Australia, the average disposable household income in the 2019/20 financial year was $1,124 per week[3] or $58,448 p.a. according to the Australian Bureau of Statistics. An annual bill of $3,248 or a quarterly bill of $812 will make up 5.6% of the average household disposable income, up from around 2.7% today.

3 Gross income minus tax, the Medicare levy and the Medicare levy surcharge, and equivalised for statistical purposes. Based on this, the non-equivalised figure for a family with one child under 15 was $2,023 and $2,360 for a family with two children under 15. The non-equivalised figure for a couple without any children was $1,686.

The price impact of decommissioning coal-fired power stations

Over the next decade, six coal-fired power stations are scheduled to be decommissioned: Yallourn W in Victoria; Liddell, Vales Point B, Bayswater and Eraring in NSW; and Callide B in Queensland. The combined capacity of these facilities is close to 11 GW and makes up 44% of the total installed capacity of coal-powered generation facilities in the NEM. It makes up 21% of the total capacity of the NEM.

Table 1: Coal-fired power stations scheduled for decommissioning by 2030

Generator	State	Exp Closure	Capacity
Liddell	NSW	2023	2000 MW
Eraring	NSW	2025	2880 MW
Yallourn W	Victoria	2028	1450 MW
Callide B	Queensland	2028	700 MW
Vales Point B	NSW	2029	1320 MW
Bayswater	NSW	2030	2640 MW

This study focuses on the impact that the closures will have on the average wholesale price of electricity,[4] changes to which will have a flow-on effect on retail prices affecting households.

To estimate the price impact of the closures of the six coal-fired power stations, we performed a quantitative event analysis on the wholesale price implications of the closures of the ten coal-fired power plants decommissioned between the years 2010 and 2020. The full list of all ten coal-fired power plants decommissioned since 2010 is presented in Table 2.

Specifically, we measured the change in the average national wholesale price of electricity in the quarter immediately prior to and in the quarter immediately following the decommissioning of each station or group of stations decommissioned in the same year.

As can be seen from Table 2, a number of coal-fired power stations closed at around the same time. This makes it difficult to attribute a price change to the closure of a given station. For this reason, we aggregate data arising from the closures of stations decommissioned in the same year. In each case where the data need to be aggregated, the pre-closure average price used as the basis of the price change calculation is the average nationwide price in the quarter immediately preceding the first plant closure of the year; the post-closure average price is the average nationwide price in the quarter immediately following the last plant closure of the year.

4 Average (nationwide) wholesale price is here defined as the average of wholesale spot prices (per MWh) in the states which participate in the NEM: Queensland, NSW, Victoria, South Australia and Tasmania.

The aggregate reduction in capacity for each year a plant was decommissioned is the sum of the capacities of the plants shut down within that calendar year. For example, the generation capacity removed from the NEM in 2012 was 1,280 MW, comprising of Munmorah's 600 MW capacity, Swanbank B's 500 MW capacity and Collinsville's 180 MW capacity.

Table 2: List of coal-fired power stations closed between 2010 and 2020

State	Station	Year of Commissioning	Date of Closure	Capacity
Queensland	Swanbank B	1970-1973	May 2012	500 MW
NSW	Munmorah	1969	Jul 2012	600 MW
Queensland	Collinsville	1968-1998	Dec 2012	180 MW
NSW	Redbank	2001	Aug 2014	143 MW
Victoria	Morwell	1958-1962	Aug 2014	189 MW
NSW	Wallerawang C	1976-1980	Nov 2014	1,000 MW
Victoria	Anglesea	1969	Aug 2015	160 MW
South Australia	Northern	1985	May 2016	546 MW
South Australia	Playford	1960	May 2016	240 MW
Victoria	Hazelwood	1964-1971	Mar 2017	1,760 MW

Source: Senate Environment and Communications References Committee - Retirement of coal fired power stations final report, 2017.

The reason that quarterly rather than annual price changes are analysed in this study is that the shorter-term analysis better enables the identification of the price impact of the closure of a specific coal-fired power station or group of stations. The limitation with an annual price change analysis is that one coal-fired power station is closed each year on average over the decade from 2010 to 2020. Thus, the annual price impact of a given decommissioning will be affected by the decommissioning of the next station.

Price changes following the decommissioning events are added up and subsequently divided by the total amount of coal-powered capacity removed between 2010 and 2020 to arrive at a figure indicating the price increase per MW capacity taken off the NEM. This figure is then multiplied by the amount of capacity to be removed from the NEM by 2030. Doing so provides an expected wholesale price increase associated with the upcoming closures.

Table 3: Price changes from coal-fired power station closures

Year	Station/s Closed	Capacity Removed	Pre-closure Quarter	Pre-closure Price/MWh	Post-closure Qtr	Post-closure Price/MWh	Δ Price
2012	Collinsville, Swanbank, Munmorah	1,280 MW	Q1 2012	$30	Q1 2013	$66	$36
2014	Redbank, Wallerawang, Morwell	1,332 MW	Q2 2014	$48	Q1 2015	$50	$2
2015	Anglesea	160 MW	Q2 2015	$37	Q4 2015	$54	$17
2016	Northern, Playford	786 MW	Q1 2016	$58	Q3 2016	$70	$12
2017	Hazelwood	1,760 MW	Q4 2016	$56	Q2 2017	$104	$48

Table 3 above outlines the price change before and after the decommissioning of a given coal-fired power station or group of coal-fired power stations.[5]

We find that for every MW of coal-generated capacity removed from the NEM over the period between 2010 and 2020, average wholesale prices on the NEM increased by approximately 2.2¢/MWh.

The next step is to apply this result to estimate the potential price changes resulting from the closures of coal-fired power stations scheduled for decommissioning in the next decade, which provides the result outlined in Table 4.

Table 4: Estimating the impact of coal-fired plant closures by 2030

Generator	State	Exp Closure	Capacity	Exp Δ Price/MWh	Exp %Δ Price*
Yallourn W	Victoria	2028	1450 MW	$31.9	41%
Eraring	NSW	2025	2880 MW	$63.4	81%
Bayswater	NSW	2030	2640 MW	$58.1	74%
Liddell	NSW	2023	2000 MW	$44.0	56%
Vales Point B	NSW	2029	1320 MW	$29.0	37%
Callide B	Queensland	2028	700 MW	$15.4	20%
Aggregated Total			10,990 MW	$241.8	310%

* Expected percentage change in price over the average wholesale spot price of electricity since the closure of Hazelwood.

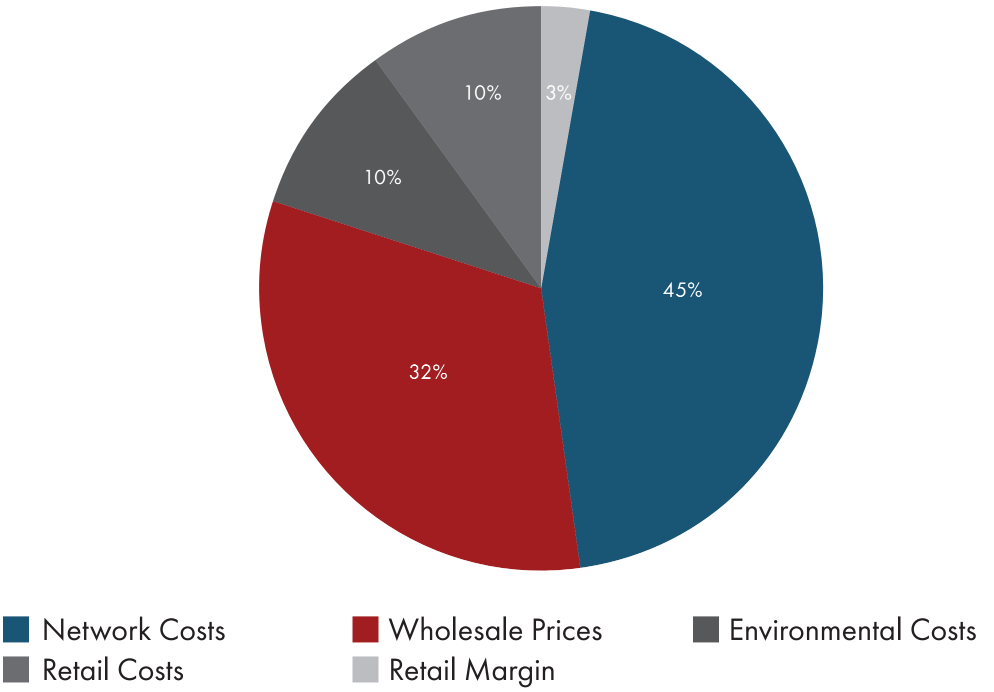
The point of comparison for the expected price increase is the average wholesale price in the five years following the closure of the Hazelwood coal-fired power station in the year 2017.

5 The Tasmanian component of the average national wholesale price of electricity in the first quarter of 2016 was normalised to control for the 2016 Tasmanian energy crisis, which resulted in unusual power disruptions and price increases.

The sum of the expected change in wholesale price, resulting from the decommissioning of the six coal-fired power stations at the centre of this study, is $242 per MWh. The average nationwide wholesale spot price over the post-Hazelwood years, between the third quarter of 2017 and the fourth quarter of 2021 (inclusive), was $78 per MWh. The estimated increase represents an increase of 310%.

The wholesale component of the cost of supplying electricity to households amounts to approximately a third, with the rest being made up of network maintenance costs, environmental and environmental compliance costs, retail operational costs and the retail margin.[6] An increase in the wholesale cost of electricity can therefore be expected to increase household electricity prices by 103%.

Graph 1: Components of retail electricity supply cost to households



Source: Australian Competition and Consumer Commission

The average annual price of electricity per household in the financial year ending June 2021 was approximately $1,600.[7] A 103% increase amounts to an increase of $1,648, which translates to an expected annual electricity bill of $3,248 per household.

State by state breakdown

- The sum of the expected change in wholesale price amounts to around a 330% increase in Queensland's average wholesale price for the relevant period. Queensland households face the prospect of a 110% increase in retail electricity bills, rising from $1,200 to around $2,500 p.a.

6 ACCC (2021, November 22), Inquiry into the National Electricity Market: November 2021 Report, Australian Competition and Consumer Commission.
7 AEMC (2021, November 25), Residential Electricity Price Trends, Australian Energy Market Commission.

- The sum of the expected change in wholesale price amounts to around a 300% increase in NSW's average wholesale price for the relevant period. NSW households face the prospect of a 100% increase in retail electricity bills, rising from $1,300 to around $2,600 p.a.
- The sum of the expected change in wholesale price amounts to around a 285% increase in Victoria's average wholesale price for the relevant period. Victorian households face the prospect of a 95% increase in retail electricity bills, rising from $1,300 to around $2,500 p.a.
- The sum of the expected change in wholesale price amounts to around a 280% increase in South Australia's average wholesale price for the relevant period. South Australian households face the prospect of a 90% increase in retail electricity bills, rising from $1,700 to around $3,200 p.a.
- The sum of the expected change in wholesale price amounts to around a 370% increase in Tasmania's average wholesale price for the relevant period. Tasmanian households face the prospect of a 125% increase in retail electricity bills, rising from $2,000 to around $4,500 p.a.

Conclusion

The closures of coal-fired power stations scheduled for decommissioning by 2030 will take 11 GW of generation capacity off the NEM, resulting in an expected price upsurge of 310% over the post-Hazelwood national wholesale spot price average. This is expected to increase retail electricity prices by approximately 103%.

In the absence of reliable and affordable replacement baseload power supply facilities in the next decade, consumers can expect to see more than a doubling in their electricity bills as a result of the closures.

The average annual price of electricity per household in the financial year ending June 2021 was around $1,600. A 103% increase amounts to an increase of $1,648, which translates to an expected annual electricity bill of $3,248 for the average household. The figures by states are as follows:

- Queensland families face the prospect of a 110% increase in retail electricity bills, rising from $1,200 to around $2,500 p.a.
- NSW families face the prospect of a 100% increase in retail electricity bills, rising from $1,300 to around $2,600 p.a.
- Victorian families face the prospect of a 95% increase in retail electricity bills, rising from $1,300 to around $2,500 p.a.
- South Australian families face the prospect of a 90% increase in retail electricity bills, rising from $1,700 to around $3,200 p.a.
- Tasmanian families face the prospect of a 125% increase in retail electricity bills, rising from $2,000 to around $4,500 p.a.

Australia's average disposable household income in the 2019/20 financial year was $1,124 per week or $58,448 p.a. according to the ABS. An annual bill of $3,248 or a quarterly bill of $812 will make up 5.6% of the average household disposable income, up from around 2.7% today.

The electricity cost relief promised by an increasing uptake in renewable sources of energy has never come to fruition. Prices are continuing to climb and this, combined with the reliability gap arising from the ongoing pressure faced by the decommissioning of reliable and affordable power stations, is putting unwelcomed additional pressure on Australian households.

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9 February 2024

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Senator RENNICK: I've discussed with the CSIRO previously how they calculate net zero and they've informed me that there are actually 40 different models for determining how you get to net zero. Do you guys discuss with the CSIRO and other related organisations which one of those 40 models you will use here in Australia and other countries will use so that there's no regulatory arbitrage in calculating how to get to net zero?

Mr Archer : Thank you for the question, Senator. I must admit I am struggling to understand it a little bit. I'm not conscious of the figure that you've mentioned that there of 40 different models for net zero. There are certainly different models for modelling the whole-of-economy impacts of responding to climate change. I wasn't aware that there were 40. That might be a number, but, from my point of view, the models all tend to be a little bit different. They can all provide insights that are important for analysis, but they don't provide the answers; they are a tool. We went through a process to select a CSIRO—

Senator RENNICK: With that in mind, how do you go about measuring the amount of CO2 that's emitted by Australian organisations? If you're not modelling it—and that's good, because I believe in measuring rather than modelling—how do you measure the way CO2 is reduced in Australia? How accurate is that? What's your margin of error on that measurement?

Mr Archer : We don't do our own estimates of Australia's greenhouse gas emissions. We use the official government estimates, which are prepared in the department.

Senator RENNICK: The environment or the energy department?

Mr Archer : The Department of Climate Change, Energy, the Environment and Water.

Senator RENNICK: Aren't you the Climate Change Authority?

Mr Archer : That's correct.

Senator RENNICK: But you don't fit within the department of climate change?

Mr Archer : We're a separate Commonwealth non-corporate entity.

Senator RENNICK: Okay. That's fine. I get confused with all these different departments. There are so many of them. Do you track how much Australian organisations, companies, NGOs or whatever else pay for carbon offsets earned offshore and how much Australian money goes offshore in earning those carbon offsets?

Mr Archer : No, we don't.

Senator RENNICK: You don't? Which department does that?

Mr Archer : I think that would possibly be a question for the department, but I'm not aware that the department is doing that specifically.

Senator RENNICK: It's says here that you undertake reviews and make recommendations on the national greenhouse and energy reporting system, including the Safeguard Mechanism?

Mr Archer : Yes, that is correct.

Senator RENNICK: Aren't carbon offsets a part of that?

Senator McAllister: Senator Rennick, respectfully, the Safeguard Mechanism is not administered by the Climate Change Authority. The design characteristics are done by the department and elements of it are managed by the Clean Energy Regulator. International offsets are not available under the safeguard arrangements, so this question about international offsets being purchased for compliance with the safeguard requirements isn't a relevant question.

Senator RENNICK: It's just that the website said that's what you do; you make recommendations on the Safeguard Mechanism.

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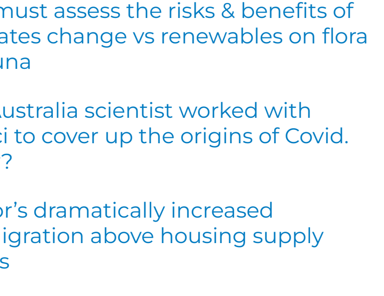

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The Missing Whole-of-System Cost Model in the AEMO 2024 ISP

The Real Cost of the NEM Transition

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

Summary

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

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

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

A More Comprehensive Capital Cost Analysis

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

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

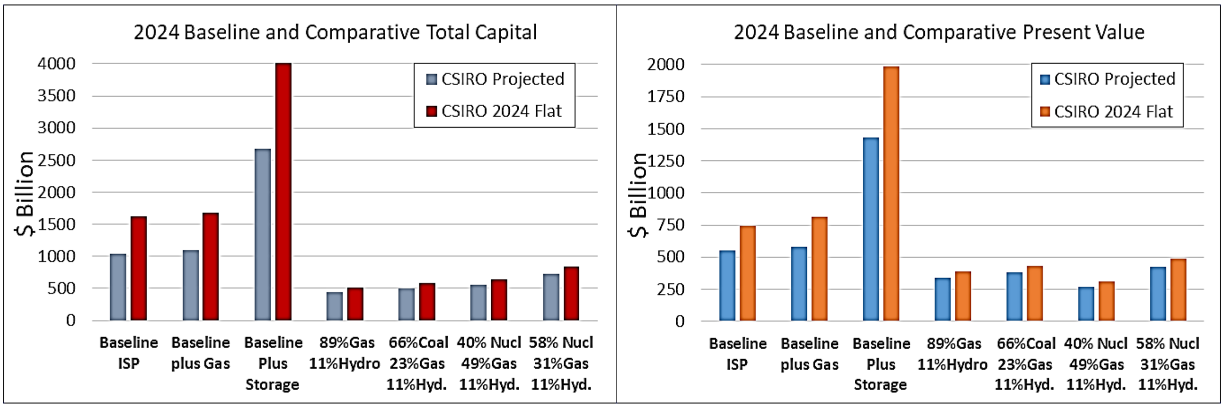

Figure 1 AEMO 2024 ISP Baseline and Comparative Whole-of-System Capital Costs in 2024 dollars

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[1] AEMO 2024 Integrated System Plan Page 74

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

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

Conclusions

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

Recommendations

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

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

Independent Engineers, Scientists and Professionals

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

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Appendices

A Estimation Methodology

B Cost Model Notes

Appendix A Estimation Methodology

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Appendix B Cost Model Notes

Baseline 20024 ISP Model Case

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

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

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

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

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

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

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

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

Baseline Plus Additional Gas Generation Case

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

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

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

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

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

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

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

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

Table 1 Baseline Plus Gas Generation Case

Baseline Plus Additional Storage and Wind & Solar Case

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

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

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

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

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

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

An 89% Gas Powered Grid Case

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

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

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

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

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

A 66/23% Coal/Gas Grid Case

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

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

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

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

A 40/49% Nuclear/Gas Grid Case

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

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

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

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

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

Table 2 Equivalent Nuclear Capital Cost Factor Adjusted for Lifetime

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

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

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

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

A 58/31% Nuclear/Gas Grid Case

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

5 July 2024
The Hon. Paul Scully MP MLA
Member for Wollongong
Minister for Planning and Public Spaces
Parliament of NSW
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Dear Mr Scully,

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

Executive Summary

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

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

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

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

Introduction

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

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

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

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

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

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

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

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

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

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

Preliminaries

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

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

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

The Issued Scoping Report at:
https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-29508870%2120211012T060833.452%20GMT
provides the further relevant information that, *"Birriwa Solar Farm which includes:*

- *the construction and operation of a solar photovoltaic (PV) energy generation facility with an estimated capacity of up to 600 MW; and*
- *associated infrastructure, including grid connection and battery storage of up to approximately 1,000 MW (with an energy storage duration of up to four hours)."*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Results

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

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

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

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

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

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

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

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

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

Yours faithfully,
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