

# The Lights Will Stay On: NSW Electricity Plan 2023-2030

Modelling shows on-schedule closure of Eraring & Vales Point Coal Power Stations is entirely doable with accelerated energy transition



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## About Climate Energy Finance

**Climate Energy Finance (CEF) is an Australian based, Australian funded think tank established in 2022 that works pro-bono in the public interest on mobilising capital at the scale needed to accelerate decarbonisation and the energy transition consistent with the climate science.**

We conduct research and analyses on global financial issues related to the energy transition from fossil fuels to clean energy, as well as the implications for the Australian economy, with a key focus on the threats and opportunities for Australian investments, regional employment and value-added exports. Beyond Australia, CEF's geographic focus is the greater Asian region as the priority destination for Australian exports, particularly India and China. CEF also examines convergence of technology trends in power, transport, mining and industry in accelerating decarbonisation. CEF is independent, works with partners in the corporate and finance sector, NGOs, government and the climate movement, and is philanthropically funded.

## About the Author - Tim Buckley

Tim Buckley, CEF's founder, has 35 years of financial market experience covering the Australian, Asian and global equity markets from both a buy and sell side perspective. Before founding CEF as a public interest thinktank in 2022, Tim founded the Australia and Asian arms of the global Institute for Energy Economics and Financial Analysis in 2013 and was Australasian Director until 2022.

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# Key Recommendations

**CEF recommends NSW Energy Minister Penny Sharpe take the following action to accelerate the energy transition in NSW and deliver on the planned closure dates for Eraring and Vales Point:**

1. Maintain the coal power plant closure schedule across NSW and accelerate renewable energy (RE) deployments at speed and scale to replace supply, permanently moderate fossil fuel price hyper-inflation, drive decarbonisation of industry and create jobs.
2. Adopt a formal NSW target of at least 70% RE by 2030 (including rooftop solar), which is moving to align with the Federal goal of 82% by 2030.
3. Urgently establish programs to implement this target at speed, front-end loading financing and approvals for both 1.2GW pa of utility-scale and 1.2GW pa of distributed energy resources (DER). NSW has 18GW of wind and 10GW of solar project proposals, plenty to choose from.
4. Take up the Federal government's program to support energy upgrades to 60,000 social housing homes nationally with matched funding from the [\\$1bn NSW Energy Security Corporation](#) and deploy that in NSW to alleviate energy poverty and get the DER buildout done at speed and scale.
5. Accelerate the rooftop solar and batteries program rollout across 21,700 buildings in 2,200 public schools.
6. Move the Federal Government to lift the [Small-scale Renewable Energy Scheme \(SRES\)](#) cap from 100kW to 1,000kW immediately to accelerate commercial and industrial (C&I) deployments. DER can deliver half of the new generation capacity needed at speed and scale, with no grid delays.
7. Accelerate approvals for RE projects that must be built rapidly ahead of coal power closures.
8. Accelerate the frequency and/or lift the ambition of the NSW Renewable Energy Zone (REZ) tenders, as has been recently done with the joint federal / state Capacity Investment Scheme (CIS) announcement, and accelerate long term energy service agreements (LTESA) tenders, providing revenue certainty for private investment in new renewables.
9. Flood the market with an underwritten low cost \$25-35/ megawatt hour (MWh) floor price (with minimum volume offtakes) via tenders for a number of new utility solar projects across state – not just REZs – over the next 12 months, de-risking these projects for investors; and expedite approvals so that they can be progressively brought online within 2-3 years. Worst case? NSW has to fund wholesale electricity at \$25-35/MWh, powering up all the new batteries and dropping average prices across the board. A win-win for consumers, industry and decarbonisation.
10. Direct Transgrid and Essential Energy to use [Neara](#) technology or similar to reassess their grid transmission and distribution (T&D) capacity constraints, in light of the lesson from PowerLink in Queensland that 10 gigawatts (GW) of new RE can be added even before major grid transmission projects are completed; and put this process in the hands of experts who are not all the Australian Energy Market Operator (AEMO) engineers. The excessive reliability focus comes at a massive cost to NSW energy users in terms of new low cost generation delay.

# Executive Summary: Key findings

NSW can ensure coal plant closures on time and put downward pressure on prices by:

1. Incentivising continued installation at the current run-rate of 1.2 gigawatts (GW) pa of rooftop solar.
2. Front-end loading at least 1.2GW annually of utility scale wind and solar to 2030.

This would replace the electricity generation capacity equivalent of 2.88GW at Eraring – Australia’s biggest coal power station, slated to close by August 2025 – and 1.32GW at Vales Point, earmarked for 2028/29 closure (when it will be an entirely end-of-life 50-51 years of age, despite recent commentary from its owners about a possible extension).

With ambition and the right accelerated policy levers, this is entirely doable, and brings with it enormous opportunities and benefits of locking in permanently lower power prices longer term, decarbonisation of industry, new jobs, and overdue action on the climate science.

**CEF’s analysis shows that there are more than enough proposed [renewable energy projects in the investor pipeline](#), and investment capital is zero problem, assuming the grid connection and approvals processes can be expedited to incentivise both early final investment decisions (FIDs) by investors and timely construction.**

Near term, renewable and battery deployments need to be expedited, to avoid the interstate grid bottlenecks.

Delaying the 2025 closure of Eraring – which risks pushing back other coal power closure dates such as Vales Point – would undermine both the NSW Government’s climate policy and the Federal Government’s 82% by 2030 renewable energy target and therefore its legislated 43% emissions reduction target.

Press suggestions that NSW retain Eraring would likely require >\$200-400m p.a. in subsidies to its operator, Canada’s Brookfield, and would be an incredible wasted opportunity to accelerate renewable energy.

Whilst the political pressure is building on NSW Minister for Climate Change and Energy Penny Sharpe to provide compensation to Brookfield to defer the closure of Eraring from 2025 for several years, CEF’s new modelling shows action now can keep NSW on track until REZs are ready to accelerate the speed of transition.

The people of NSW would be far better served by allocation of this capital to accelerate state renewable energy and battery developments.

This money should be invested in immediately alleviating energy poverty by accelerating deployment and aligning incentives for rooftop solar and ‘electrification of everything’ for rental accommodation and public housing; accelerating the public school solar and storage scheme; and supporting ‘behind the meter’ battery storage in homes and buildings, and virtual power plants (VPPs) – decentralised networks of power generation and storage.

Commercial and industry (C&I) uptake should be accelerated by getting a Federal expansion of the small-scale renewable energy scheme (SRES) from 100 kilowatts (kW) to 1 megawatt (MW).

Appropriately ambitious and targeted decarbonisation policy in NSW will deliver secure energy supply to the people of the state and enable the phase-out and closure of coal-fired power – including Eraring in 2025 – in accordance with the planned timelines.

NSW should also deploy [NEARA](#) technology (3D interactive grid infrastructure capacity modelling) to infill renewables where grid capacity is available, accelerate and upscale biannual tenders offering minimum prices, and add minimum volume offtake agreements so as to share near term curtailment (wasted generation) risks. More supply means lower prices for NSW consumers.



## **Investment and project pipeline**

NSW has over 18GW of wind projects alone in the approvals process and almost 10GW of major solar project proposals in train, sufficient to deliver on the 1.2GW pa of new utility scale capacity NSW needs. We just need to get these projects to FID and under construction.

The investor profiles in our accompanying [Appendix to this report](#) highlight plentiful capital and investor proposals, supporting AEMO's guidance of a strong pipeline of generation proposals in the National Energy Market (NEM), bringing these projects to market and connecting them to the grid should be expedited.

As AEMO has observed, there is no shortage of capital to support Australia's energy transition, nor any shortage of new energy project proposals, with 200GW of renewables and 40GW of storage in the pipeline nationally as at June 2023.

## **Policy context**

March 2023 saw the new Minns Labor Government elected to lead NSW. The Minister for Climate Change, Environment, Energy and Heritage, Penny Sharpe, has committed to continue the ambitious electricity sector transformation commenced by the previous government.

NSW Government policy priorities include Renewable Energy Zones (REZs), accelerated decarbonisation, and facilitating the building of low cost, zero emissions, domestic replacement generation capacity to replace the end of life coal power plants that NSW has historically relied upon.

Federally, Australia finally has a commitment to act on climate but needs to act at greater speed to embrace the seismic shift required in energy, resources, industry and climate policy. There is positive momentum, with the first 14 months of the Albanese Government seeing: an 82% RE by 2030 target; the Climate Change Act 2022; the legislation of the Safeguard Mechanism; the \$20bn funding of the Rewiring the Nation; the proposed Capacity Investment Scheme; a \$1.3bn 'downpayment' in the 2023 budget for 'Electrification of Everything'; and Net Zero Authority establishment.

## **NSW electricity demand and generation trends**

We model NSW electricity demand reaching 83 terawatt hours (TWh) per annum (pa) by 2030, reflecting an acceleration in annual electricity demand from 0.04% pa compound annual growth rate (CAGR) over the last two decades to 1.5% annually as we electrify everything, including transport.

With the phase-down closure of Eraring over 2025/26 and Vales Point over 2028/29, coal power's share is forecast to plummet by half from 62% in calendar year 2022 (CY2022) to 23.5% by CY2030. The closure of the Liddell Power Station in April 2023 has passed with minimal fuss and the lights stayed on. It is good to see the NSW Energy Minister taking on these lessons, undertaking a rapid review to ensure NSW stays on track in its overdue decarbonisation journey.

With the assumption of 1.2GW pa of rooftop solar and 1.2GW pa of utility scale wind and solar installs in NSW, renewable energy generation is forecast to rise from 28% in CY2022 to reach 63% by CY2030. 82% nationally is impossible unless NSW accelerates, rather than delays further.

## **NSW energy investment and capacity installs**

NSW is set to invest over \$40bn in grid transmission, generation and storage capacity over the 8 years to 2030. The costs to NSW ratepayers will be much higher with delayed coal closures.

CEF's modelling shows that NSW needs to install 1.2GW per annum (pa) of new utility scale wind and solar projects and 1.2GW pa of DER through to 2030 to deliver the additional generation capacity needed to replace retiring end-of-life coal power plants.

This will see 10GW of rooftop solar across another 400,000 new houses and 50,000 commercial and industrial (C&I) rooftops, plus 8-10GW of new utility scale wind and solar projects; supported by massive battery firming and longer term by new interstate transmission and pumped hydro storage.

This would see the utility scale renewable energy (RE) share lift from 27% in 2023 to 35% by 2030.

On rooftop solar, NSW already has over 5.3GW installed across residential and C&I premises.

In 2023, NSW is installing a record 100MW per month, double the assumption modelled in the Australian Energy Market Operator's (AEMO) Integrated System Plan (ISP). NSW should target 20GW of rooftop solar by 2030 vs AEMO's 12GW forecast.

We conservatively model 1.2GW pa of additions to 2030, adding an incremental 1,846 gigawatt hours (GWh) pa of distributed generation. This would imply 21 TWh pa by 2030, 25% of CEF's forecast NSW electricity demand of 83 TWh pa.

The opportunity for smart, co-ordinated virtual power plants (VPP) to strengthen the grid and deploy distributed capacity quickly and cost-effectively should be the top energy priority of the NSW and federal governments.

In addition to rooftop solar, this should include battery storage, ground heat pumps for heating water, creating a massive reduction in household energy demand, EV charging – batteries on wheels to time-shift excess generation into the evening peak – and demand response management.

### **Enabling transmission infrastructure in NSW**

Grid transmission is a key enabling infrastructure investment, and needs to be expedited, consistent with Transgrid's \$16.5bn June 2023 Roadmap.

Concurrent with this, Transgrid and NSW's three distribution grid operators need to re-evaluate the grid constraint assumptions and provide as much new capacity as is possible within the existing grid.

After a decade of gold-plating, there has to be significant underutilised spare capacity. When Queensland's grid operator PowerLink did this assessment, it found 10GW of variable renewable energy (VRE) capacity could be immediately accommodated, with serious upside for Queensland consumers, and for expediting the state's decarbonisation and capacity replacement objectives.

Further, the system wide costs of grid congestion are over-emphasised, when considered in the context of the benefit of lower wholesale electricity prices, and co-locating solar and batteries will allow a time shift to much higher evening peak supply.

The NSW Government should flood the market with cheap solar via stimulating rooftop installs and providing floor price utility-scale tenders, and provide a minimum paid offtake volume to compensate for some near term curtailment. This in turn incentivises battery arbitrage – purchasing and storing energy at low priced times to sell at high priced times – to progressively solve this 'problem'.

NSW needs to get moving, even as it prioritises the long term grid infrastructure investments needed to enable the REZs, particularly in light of delays with Snowy 2.0.



## **Storage and firming**

The Snowy 2.0 debacle of capital expenditure (capex) cost and timetable blowouts highlights that while pumped hydro storage (PHS) might play a key role in seasonal grid firming, that role is cost and time prohibitive and therefore likely to be significantly smaller than anticipated even two years ago.

The global investment in battery manufacturing capacity and battery installations is booming, growing far faster than any thought possible even just one year ago. Global battery investments doubled in 2022, and are on track to nearly double again in 2023. Double digit annual cost deflation is likely over the coming decade, like solar.

Fast to deploy, batteries will play the key role in grid firming and time-shifting ever cheaper solar generation. Australia needs to roll out its federal Capacity Investment Scheme at speed and scale, as was demonstrated in partnership with the NSW Government in June 2023. NSW has a staggering investor pipeline of proposals for 10.8GW/31.2GWh of battery energy storage systems (BESS).

## **The declining role of gas may render Santos' Narrabri project redundant**

Gas generation will play a small but important role in firming power, representing a 3.5% share through to 2030 as the Kurri Kurri and Tallawarra B gas peaking plants are brought on line.

NSW installed a record of 9,698 air-source heat pump systems in the first quarter of 2023 (1Q2023), a 12-fold increase year-on-year, showing a pivot point has been reached in the transition away from domestic use of gas to household electrification. Consumer education and supportive NSW policy inducements could accelerate this further.

This confluence of the factors would make Santos' heavily opposed (including by First Nations' Traditional Owners), long delayed, and environmentally destructive Narrabri gas proposal – which is entirely inconsistent with the climate science and direction of global energy transition – redundant.

## **Decarbonisation of industry**

As REZs progressively come on line, this will open up massive opportunities to decarbonise the national electricity market (NEM) on the east coast, including NSW, as well as the southwest interconnected system in WA (SWIS) plus the yet-to-be-established common user grid in the Pilbara.

The unprecedented, massive development of industrialised firm renewable energy infrastructure will catalyse a sustainable competitive advantage for Australian manufacturing and refining, including in NSW. Scaling abundant low cost, deflationary zero emissions electricity to power heavy industry means we can export 'embodied decarbonisation' in Rio Tinto's Tomago world-scale green aluminium smelter and industry, as well as underpin a progressive move to green steel at BlueScope's potential new electric arc furnace at Port Kembla.

## Section 1: NSW Electricity Grid Roadmap

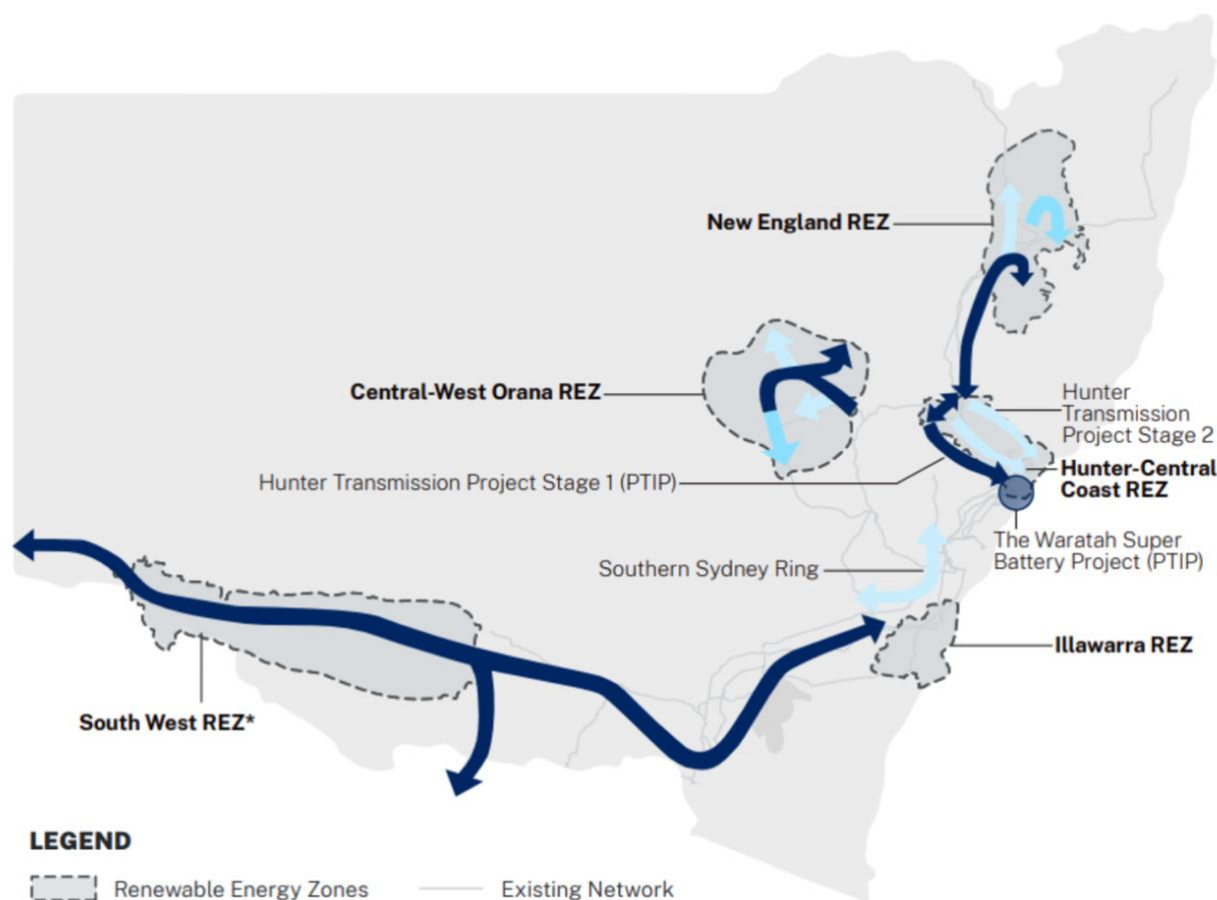
In May 2023 EnergyCo released its 20 year [Network Infrastructure Strategy](#) to guide the coordination of NSW network infrastructure to connect new generation and storage in NSW's five Renewable Energy Zones. It will also meet the [Electricity Infrastructure Investment Act 2020](#) objectives.<sup>1</sup>

The Roadmap aims to deliver by 2030 at least:

- 12GW of new renewable electricity generation; and
- 2GW of long-duration storage, such as pumped hydro.

An accelerated scenario for the closure of all coal-fired power plants coming forward to 2030 would require another 3GW of large and small scale renewables and 2GW of storage.

**Figure 1.1: NSW Electricity Infrastructure Roadmap**



Source: NSW Government, [Network Infrastructure Strategy for NSW](#)

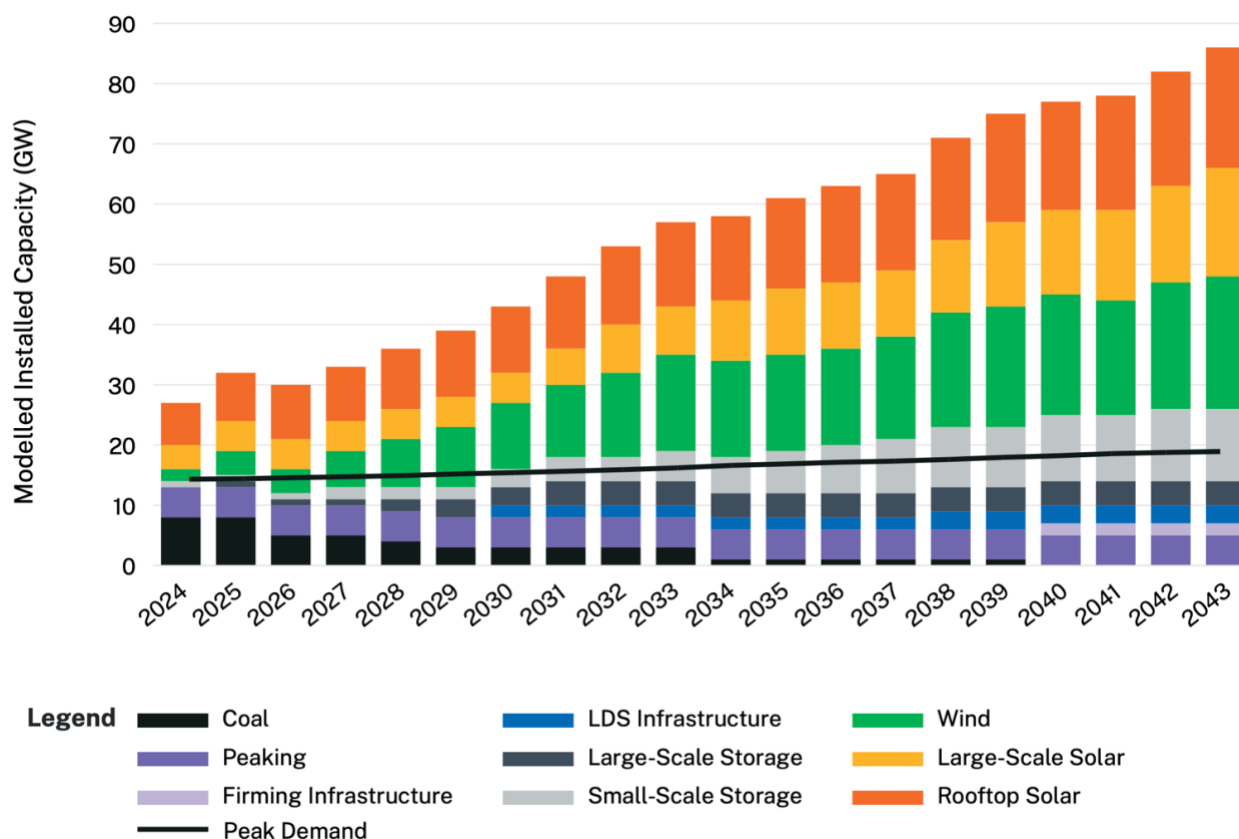
The Roadmap aims to give industry and investors the certainty they need to invest in the infrastructure we need, with more than \$32b of private sector investment to be injected into the NSW economy by 2030, but to-date the progress has been behind schedule, and needs to be accelerated.

<sup>1</sup> NSW Government, [Electricity Infrastructure Roadmap](#)

Complementary measures that don't require major grid transmission buildouts as a prerequisite should also be advanced. In particular, a re-assessment of existing grid T&D capacities is needed, to allow infill of new projects – distributed and utility scale – with the latter on a phased introduction so progress can be made now and projects started soonest, with a scaling up once additional transmission capacity is unlocked.

NSW approvals are coming way too slowly and have of late slowed rather than accelerated as excessive focus is put on REZ sites that can't be commenced for 4-6 years.<sup>2</sup>

**Figure 1.2: NSW Electricity Generation Storage and Firming Capacity (GW)**



Note: As modeled by AEMO Services under its Central Scenario

Source: NSW Government, [Network Infrastructure Strategy for NSW](#)

Delivery of the Roadmap has advanced with the announcement of the [Waratah Super Battery](#) in late 2022, and with AEMO Services launching the inaugural tender round for new generation and long duration storage [Long Term Energy Service Agreements \(LTESAs\)](#) beginning in 2022. Tenders for firming infrastructure, generation and long duration storage are scheduled to be twice-yearly, on a proposed ten-year rolling schedule.

### Tender Round 1 – generation and long-duration storage

<sup>2</sup> Renew Economy, [Wind and solar face planning brick wall that threatens to derail switch from coal](#), 5 July 2023

AEMO Services inaugural tender for generation and long-duration storage received strong interest from the market. 16 projects representing more than 4.3GW of generation and long-duration storage were assessed for deliverability and social licence, and shortlisted to proceed to the financial value assessment stage of the tender process, showing the depth of investor interest.

RWE won a 50MW/400MW BESS allocation, the first 8 hour utility scale battery to be built in Australia, and one of the first globally.<sup>3</sup>

Round 1 delivered was priced at 40% below their levelised cost of energy (LCOE), giving a minimum floor price of A\$35/MWh for solar and below A\$50/MWh for wind, both exceptional results for NSW citizens. ACEN Australia won offtake agreements for its 400MW Stubbo Solar Farm and 720MW New England Solar Farm. Goldwind Australia won support for its 275MW Coppabella Wind Farm.<sup>4</sup>

NSW energy minister Penny Sharp said the results of the auction meant that NSW has now locked in 4.1GW, well on its way to its legislated 12GW target by 2030, and all well before any of the transmission grid infrastructure for the REZ is enabled. Infill capacity is key.

### **Tender Round 2 – firming infrastructure**

May 2023 saw Tender Round 2 open, seeking ~1,000MW of wind and solar plus 920MW shorter duration firming infrastructure (refer CIS, Section 2).<sup>5</sup>

### **Tender Round 3 – generation and long-duration storage**

Registration is now open for an indicative amount of 2,500GWh (around 950MW) of generation and 550MW of long duration storage, however AEMO Services notes it can award more or less if it is in the long-term financial interest of NSW consumers.

The current generation capacity installed in NSW is dominated by coal (8.2GW, 31%), rooftop solar (5.3GW, 20%), utility solar (3.8GW, 14%), wind (2.2GW, 8%), hydro/PHS (4.9GW, 18%) and methane gas (1.9GW, 7%) – Figure 1.3.

### **Figure 1.3: NSW Installed Electricity Capacity as at June 2023 (MW)**

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<sup>3</sup> Renew Economy, [RWE says Australian eight hour battery win puts it on path to 3GW of storage](#), 1 May 2023

<sup>4</sup> Renew Economy, [NSW gets stunning low price for wind and solar in biggest renewables auction](#), 1 May 2023

<sup>5</sup> Renew Economy, [NSW to open second gigawatt scale wind, solar and storage tender on Monday](#), 19 May 2023

Fuel Source	Capacity MW	Share %
Hydro	4,855	18%
Utility scale solar	3,766	14%
Rooftop solar	5,291	20%
Wind	2,221	8%
Battery	230	1%
Gas	1,889	7%
Coal - Bayswater	2,640	10%
Coal - Eraring	2,880	11%
Coal - Mt Piper	1,400	5%
Coal - Vales Point B	1,320	5%
Gas (Waste Coal Mine)	118	0%
Bioenergy (Biogas)	102	0%
Disillate	205	1%
<b>Total</b>	<b>26,917</b>	<b>100%</b>

Source: OpenNEM, CEF calculations

## Section 2: 2030 NSW Electricity Demand & Supply

*We model NSW electricity demand reaching 83TWh pa by 2030, reflecting an acceleration in electricity demand from 0.04% pa CAGR over the last decade to 1.5% annually as we electrify everything, including transport.*

*With the end-of-life phase down closures of Eraring over 2025/26 and Vales Point over 2028/29, coal power's share is forecast to drop from 58% in CY2023 (down from 62% in CY2022 with the closure of Liddell in April 2023) to just 23.5% by CY2030.*

*With the assumption of 1.2GW pa of rooftop solar and 1.2GW pa of utility scale wind and solar, renewables generation is forecast to rise from 38% in CY2023 to 63% by CY2030. There are far more than enough proposed RE projects in the investor pipeline, and capital is zero problem, assuming grid connection and approvals processes are expedited to incentivise early FIDs and construction.*

*Gas generation will play an important but small role in firming power, representing 3.5% share of generation by 2030 as Kurri Kurri and Tallawarra B come online, flat on 2022 levels.*

**Figure 2.1: Forecast Electricity Demand Growth and Generation Mix for NSW pa**

Date	Total Demand	Total Demand annualised	Total RE Generation	Rooftop included in Total RE	RE Share (utility + rooftop)	Rooftop share	NSW Fossil fuel share	Coal Share	Coal power
2011	77,756	0.1%	2,615	402	3.4%	0.5%	86.9%	82.2%	63,901
2012	73,765	-5.1%	4,593	570	6.2%	0.8%	82.6%	77.0%	56,817
2013	71,284	-3.4%	4,505	755	6.3%	1.1%	86.8%	80.7%	57,531
2014	70,970	-0.4%	3,290	940	4.6%	1.3%	82.1%	76.7%	54,413
2015	71,802	1.2%	4,913	1,165	6.8%	1.6%	81.7%	76.2%	54,687
2016	72,477	0.9%	7,530	1,374	10.4%	1.9%	78.5%	74.9%	54,286
2017	73,173	1.0%	6,012	1,545	8.2%	2.1%	82.8%	78.8%	57,636
2018	73,306	0.2%	9,053	2,173	12.3%	3.0%	80.1%	78.3%	57,414
2019	74,102	1.1%	10,717	2,952	14.5%	4.0%	79.3%	76.6%	56,732
2020	72,598	-2.0%	12,837	3,764	17.7%	5.2%	74.0%	72.5%	52,657
2021	72,258	-0.5%	16,456	5,001	22.8%	6.9%	69.6%	68.2%	49,309
2022	74,041	2.5%	20,523	5,878	27.7%	7.9%	65.7%	62.4%	46,200
2023	74,767	1.0%	23,155	7,738	31.0%	10.3%	61.5%	58.2%	43,481
2024	75,889	1.5%	26,445	9,493	34.8%	12.5%	57.7%	54.3%	41,174
2025	77,027	1.5%	25,665	11,248	33.3%	14.6%	56.1%	52.4%	40,351
2026	78,182	1.5%	39,078	13,003	50.0%	16.6%	39.6%	35.9%	28,094
2027	79,355	1.5%	40,250	14,758	50.7%	18.6%	39.1%	35.4%	28,094
2028	80,545	1.5%	42,283	16,513	52.5%	20.5%	37.4%	33.8%	27,251
2029	81,754	1.5%	44,309	18,268	54.2%	22.3%	35.9%	32.3%	26,433
2030	82,980	1.5%	52,473	20,023	63.2%	24.1%	27.0%	23.5%	19,495

Source: OpenNEM, CEF calculations

CEF has modelled NSW electricity demand reaching 83TWh pa by 2030, reflecting an acceleration to 1.5% pa growth in annual electricity demand from the 74TWh in CY2022. This growth rate sounds low, but we note this is a significant lift from 0.04% pa compound annual growth rate (CAGR) over each of the last two decades – Figure 2.2.

**Figure 2.2: Forecast Electricity Demand Growth for NSW pa**

Period	CAGR pa
2002-2012	0.04%
2012-2022	0.04%
2023-2030	1.50%

Source: OpenNEM, CEF calculations

AEMO's Integrated System Plan (ISP) models a higher 2.7% pa CAGR, but we note that modellers of electricity demand have overestimated demand growth for the last two decades, and this has resulted in goldplating and underutilisation of the grid transmission, which represents a massive 50% of the average NSW electricity retail bill.

Should we be conservative, and should NSW accelerate its gas substitution roadmap (yet to even be launched), its EV roadmap (yet to be launched), and the 'electrification of everything' (yet to be launched), any shortfall will be easily remedied by the dramatic improvement in building energy efficiency that can be achieved across both residential and commercial from improved Nationwide



Housing Energy Ratings Scheme (NaTHERS) codes and the rollout of energy efficient ground heat pumps, complemented by an acceleration of rooftop solar installs.

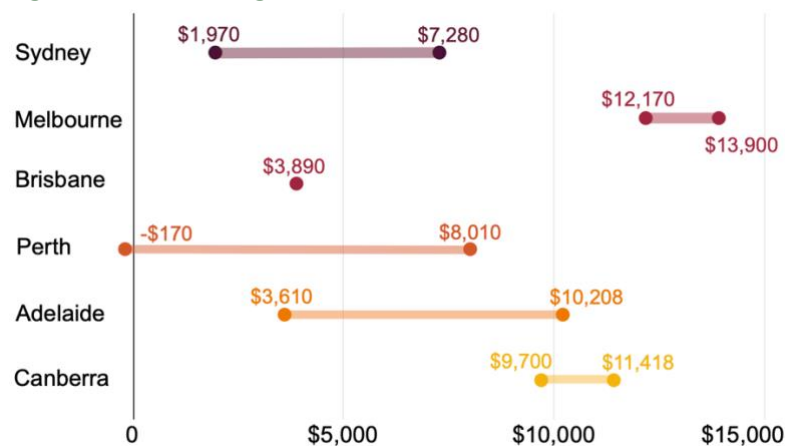
## 2.1 Electrification of Everything & Gas Substitution

*NSW installed a record 9,698 air source heat pump systems in 1Q2023, a 12-fold increase year-on-year, showing a pivot point has been reached. Consumer education and supportive NSW policy inducements could accelerate this further, making redundant Santos’ heavily opposed, long delayed Narrabri gas proposal, which is entirely inconsistent with the climate science and direction of global energy transition.*

Modelling from Rewiring Australia, headed up by Professor Saul Griffith, demonstrates that electrification with commercially-available technologies is the fastest, cheapest way to combat inflation and decarbonise the economy. At the household level, Griffith says replacing gas fired heating, water, cooktops and petrol/diesel cars with efficient electric alternatives and then powering them with rooftop solar can slash between \$3,000 and \$5,000 from annual energy bills. “A small commitment now from the state governments and federal governments can actually release a huge saving for the nation down the road,” Griffith said in February, launching a NSW pilot to electrify homes with existing gas connections.<sup>6</sup>

A June 2023 Grattan Institute report reaches the same conclusion, with Figure 4.3 showing NSW residents would save \$1,970-7,280 per household net of up front capital costs, with the priorities of rooftop solar, batteries-on-wheels, induction cooktops, ground heat pumps and water heaters.<sup>7</sup> This conclusion is reinforced by the 20% average retail electricity price increase commencing July 2023.<sup>8</sup> Grattan Institute’s Alison Reeves makes it clear that government policy is a key enabler of this shift to save households money, in terms of education of the public, training of the numbers of electricians and apprentices needed, and via the Clean Energy Finance Corporation (CEFC) providing the upfront capital to enable renters and low-income households to move to renewables.

**Figure 2.3: Savings to Sydney households Over a Decade**



Notes: Includes the upfront cost in savings calculations. See Appendix B for further detail.

<sup>6</sup> Renew Economy, [ACT passes first law in Australia banning gas in new homes, as fossil empire strikes back](#), 8 June 2023

<sup>7</sup> Grattan Institute, [Getting off gas: why, how, and who should pay?](#), June 2023

<sup>8</sup> Australian Energy Regulator, [AER releases final determination for 2023–24 Default Market Offer](#), 25 May 2023

*Sources: Grattan analysis (2023) of Energy Consult (2021) and retail data.*

The ACT government has a ‘sustainable household scheme’ providing up to \$15,000 in zero-interest loans. Means-testing an offer like this for NSW – capped monthly to ensure a steady stream of work rather than driving a boom-bust– would be an ideal way to reduce energy waste and the energy poverty being inflicted on Australians by the multinational cartel of fossil fuel exporters who exploit NSW’s notionally ‘public’ coal and gas resources for private returns.

Given the NSW Government has over 40,000 state owned and managed Indigenous residential properties, and another 30,000 community properties, there is an obvious opportunity for the state to drive renewables uptake and savings for those most suffering from fossil fuel energy poverty, and to train the electricians needed to undertake this. This should be a priority and would align with and leverage the Federal Government’s 2022 MYEFO for indigenous housing and 2023 Budget allocation of \$300m to improve energy efficiency for 60,000 social housing properties. Senator McAlister in June 2023 described the \$1.6bn program as a good “down-payment”.

Additionally, CEF would again note longevity and clarity of public policy programs is essential to crowd-in private small and medium enterprise (SME) capacity and capital on this front, particularly in terms of taking on new apprentices.

The Grattan Institute estimates the number of new NSW methane gas connections has grown by 37% since 2010. As such, rather than allowing investment in yet more long-dated fossil fuel infrastructure, which will inevitably become stranded and redundant as the transition accelerates, the NSW government should immediately ban new connections and also mandate that all new public housing is fully electrified on construction.<sup>9</sup>

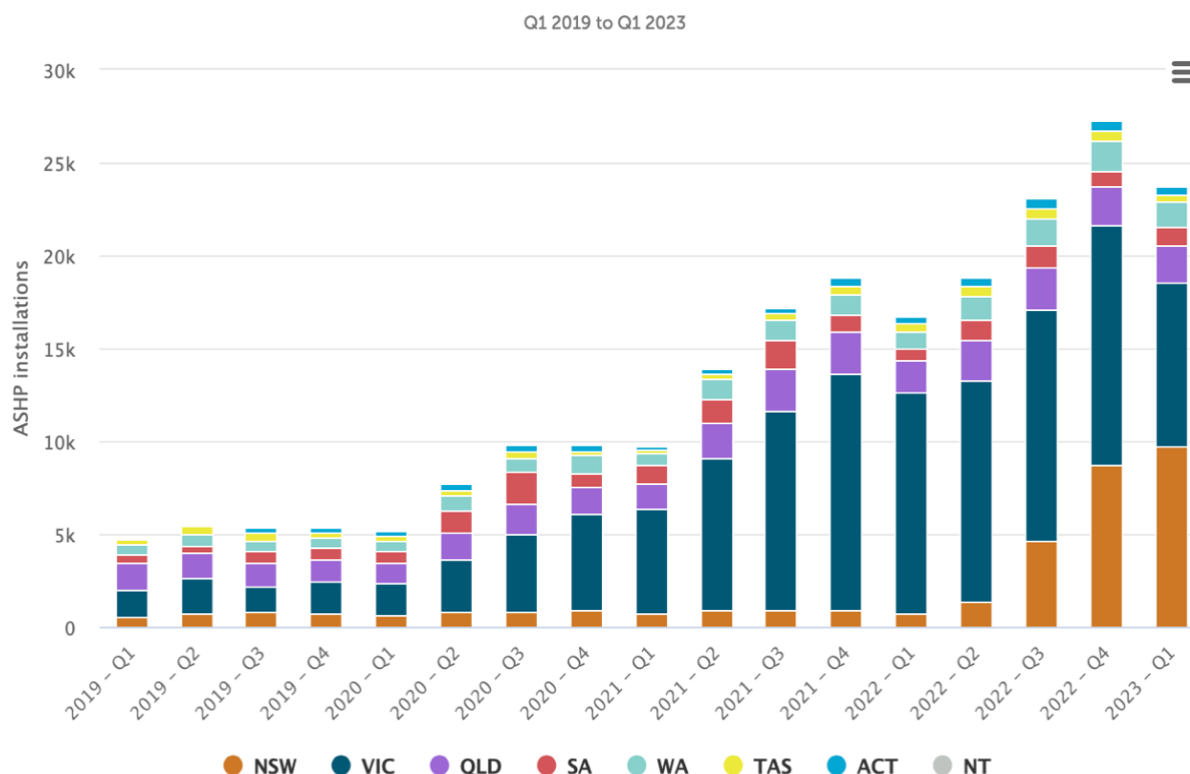
While rooftop solar PV remains a popular choice with households and businesses, the massive upsurge of installation of energy efficient water heaters has defied expectations. The Clean Energy Regulator reports that 24,000 air source heat pumps were installed in 1Q2023 across Australia, 40% higher than 1Q2022. For the first time, NSW surpassed Victoria as the state with the highest number of air source heat pump installations in a quarter. NSW installed 9,698 systems in 1Q2023 (vs just 712 units in 1Q2022), showing how quickly momentum can build in the face of energy poverty pressures.<sup>10</sup> Upfront costs to consumers to install air source heat pumps continue to be very low where there are state government incentives in addition to the support from the federal small-scale renewable energy scheme (SRES).

## **Figure 2.4: Australian Air source heat pump (ASHP) installations by state**

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<sup>9</sup> The SMH, [Deadline needed for gas appliance ban if Australia to reach net zero: Grattan](#), 19 June 2023

<sup>10</sup> Australian Energy Regulator, [Small-scale technology certificates \(STCs\)](#), May 2023



Source: Clean Energy Regulator, *Small-scale technology certificates (STCs), March 2023 Quarter report*

## Gas Substitution

Australian consumers and insurers are increasingly aware of the massive health costs of pumping toxic methane gas into our homes and buildings, and there is a growing call to ban new methane gas connections and progressively phase out existing connections.

After decades of greenwash and consumer deception of the merits of cooking with methane gas, the rise of technologically superior induction cooking and ground heat pumps and the increasing hyperinflation of methane gas prices in NSW has seen progress on a methane gas phase out. The methane gas industry – led by the Chinese/Singapore Governments-owned Jemena – has even responded with an irresponsible \$500 consumer bribe to substitute methane gas for electric appliances to lock-in demand over the current replacement cycle.<sup>11</sup>

June 2023 saw the ACT government leading the way in voting through its Climate Change and Greenhouse Gas Reduction (Natural Gas Transition) Amendment Bill to ban the connection of new homes and businesses to the gas network.<sup>12</sup> ACT energy minister Shane Rattenbury stated: “The first step in phasing out gas completely is to prevent the installation of any new gas.”

Victoria follows not too far behind with Energy Minister Lily D’Ambrosio’s “gas substitution roadmap,”<sup>13</sup> which at this stage is incentivising households to invest in efficient electric alternatives to gas for home heating and hot water.

## Heat Pumps and Switching Water Heating to Midday from Midnight

<sup>11</sup> Renew Economy, [Cash for gas: Networks offer rebates, cash bonuses to keep home fossils burning](#), 9 June 2023

<sup>12</sup> Renew Economy, [ACT passes first law in Australia banning gas in new homes, as fossil empire strikes back](#), 8 June 2023

<sup>13</sup> Victorian Government, [Public Accounts and Estimates Committee 2023-24 Budget Estimates Hearing](#), 8 June 2023

As the Grattan Institute reports in June 2023,<sup>14</sup> the shift from gas water heaters to heat pumps would create a massive reduction in household energy demand, reducing consumer energy poverty even as it permanently cuts fossil gas demand and carbon and methane emissions:

*“Heat pumps are a special type of electric appliance that are even more efficient than conventional electric appliances. Heat pumps contain a fluid that absorbs heat from the air. When the fluid is pumped through an expansion valve, it sheds the heat, which is then transferred into whatever is being heated. Because the heat is absorbed from the air, the only electricity used is to run the pump. Heat-pump water-heaters, reverse-cycle air-conditioners, and fridges all work this way.*

*Water heaters are a good example of conversion efficiency differences. Providing sufficient hot water for a family of four for a year requires about 30,000 MJ of gas used in an instantaneous gas water heater. Providing the same amount of hot water using an electric storage water heater requires about 6,500kWh of electricity, equivalent to 23,400 MJ. Using a heat-pump water-heater requires about 3,300kWh, or 11,900 MJ.”*

Additionally, adjusting the default “off-peak” hot water heater setting of the middle of the night would immediately reduce coal power generation dramatically, and better align household electricity demand with the solar generation peak, taking severe advantage of duck curve economics.

This begs the question of why this switch hasn’t been hit as yet?

## 2.2 EVs

AEMO projects Australia will have 2.8 million EVs on the road by 2030 in Australia.<sup>15</sup> This projection will prove too low, and means there is massive upside to grid reliability from vehicle-to-grid charging.

Ampol aims to have 300 fast-charging bays active by the end of 2024, well up on their 5 currently, illustrating the accelerating investment in enabling charging infrastructure as the transition hits.<sup>16</sup>

## 2.3 Building Efficiency & Energy Efficiency

August 2022 saw state and federal ministers agree to update the National Construction Code (NCC) to require new residential dwellings to achieve the equivalent of 7-stars on NaTHERS for whole-of-house energy use, including hot water, heating, cooling and pool pumps. Implementation is at the state level, with mid-2023 targeted.<sup>17</sup>

The NSW Government in August 2022 introduced its State Environmental Planning Policy (Sustainable Buildings) 2022 to lift the NaTHERS / BASIX standard from 5.5-6 to 7 stars from October 2023.<sup>18</sup>

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<sup>14</sup> Grattan Institute, [Getting off gas: why, how, and who should pay?](#), June 2023

<sup>15</sup> AEMO IASR 2023 – ‘Orchestrated Step Change’ (previously referred to as ‘Step Change’ scenario).

<sup>16</sup> AFR, [Delay Eraring closure as ‘insurance’, says Transgrid’s Redman](#), 20 June 2023

<sup>17</sup> One Step off the Grid, [Home energy efficiency standards to be raised as Australia plays catch-up](#), 30 August 2022

<sup>18</sup> [State Environmental Planning Policy \(Sustainable Buildings\) August 2022](#)

## Section 3: Coal Plant Closures

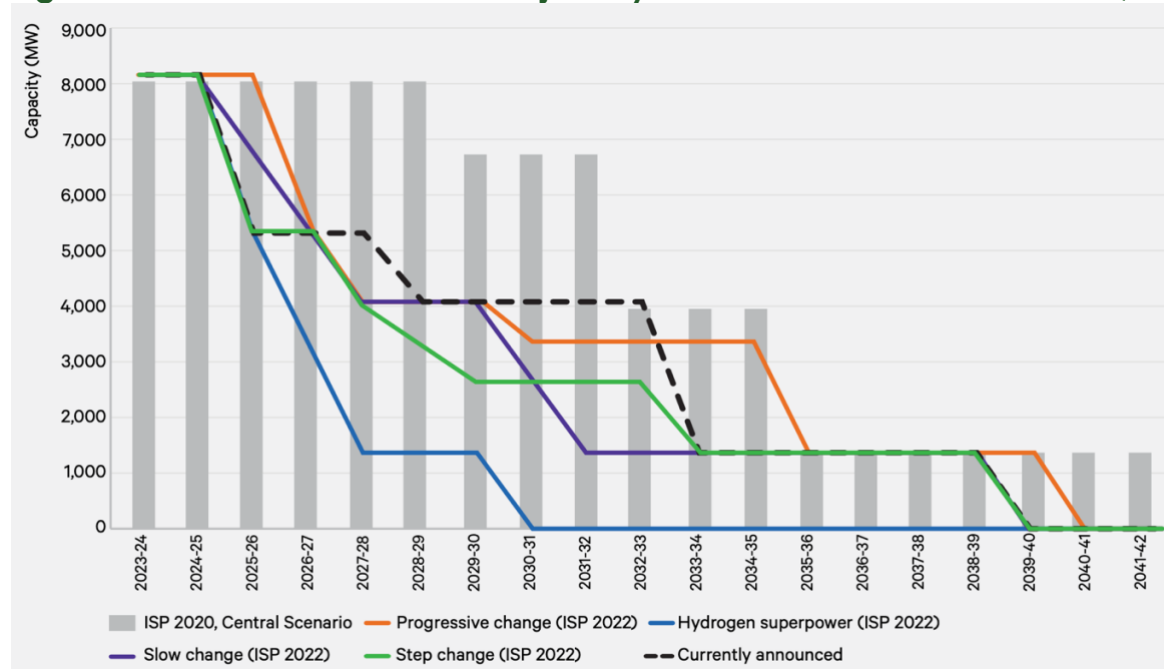
*Whilst lobbyist pressure is building on NSW Energy Minister Penny Sharpe to provide an estimated at >\$200-400m pa of compensation to Brookfield to cover the purchase of thermal coal at current spot export prices twice the long term average, and capex to keep the plant safe to operate, so as to defer the closure of Eraring from 2025 for several years, CEF models that this pressure is misplaced. NSW ratepayers would be far better served by allocation of this capital to accelerate REZ developments and buy time via accelerated NSW deployments of distributed energy resources including rooftop solar, behind the meter storage and VPPs.*

Historically, coal generation has dominated the NSW power system. In 2011, coal represented 82% of NSW's electricity generation. Fast forward 16 years to 1HCY2023 and that figure is considerably lower but still 61%.

A combination of approaching end-of-life coal assets, rising low input prices as legacy coal supply contracts expire, falling daytime electricity prices and rising environmental and social license pressures are accelerating coal owners' plans for plant retirements. This is observed in the acceleration of coal retirement timing compared to what was projected in 2020. AEMO's 2022 ISP projects that by 2033, only 17% of NSW's electricity generation will come from coal.

CEF modelling is consistent with this, forecasting that coal's share will decline to 23.5% by CY2030 – Figure 2.1 above. Over the next decade, 80% of NSW's coal capacity is expected to retire, representing 7GW of generation capacity exiting the system. Transgrid notes the planned rate of decommissioning of coal units in NSW is four times higher than has been observed in Europe or the US over the last 5 years, proportional to total generation capacity.<sup>19</sup> But we need decisive action!

**Figure 3.1: NSW coal retirement trajectory: AEMO 2022 draft and final ISP, and 2020 ISP**



<sup>19</sup> Transgrid, [Transgrid Roadmap to secure grid in the clean energy transition](#), 21 June 2023, citing Global Energy Monitor

### 3.1 Liddell

2022 saw AGL Energy's decision to close its increasingly unreliable, ultra-high emissions, expensive end-of-life Liddell coal fired power plant north-west of Singleton in the Hunter Valley by 2023,<sup>20</sup> the Bayswater coal fired power plant by 2030-2033 and Victoria's Loy Yang A coal plant by 2035.<sup>21</sup> Noting NSW imports significant low cost but high emissions lignite-powered electricity from Victoria, the need for replacement with NSW sited zero emissions low cost generation capacity at world scale is critically time sensitive.

Liddell was shut down in April 2023.<sup>22</sup> At 52 years, it was well beyond its 40 year design life.

### 3.2 Eraring (2,880MW)

February 2022 saw Origin Energy, working in partnership with the then NSW Treasurer Matt Kean, announce it would accelerate the closure of Australia's largest coal-fired power plant, Eraring, by seven years to August 2025.<sup>23</sup>

There are growing market rumours of a delay to the closure of Eraring, ignoring the massive taxpayer cost of this suggestion. Transgrid notes that closure is still feasible assuming NSW maintains and builds electricity sector decarbonisation momentum, stating: "Coal closures are happening. It's now well past the tipping point and there is a risk coal closure can happen faster rather than slower."<sup>24</sup>

A key issue beyond the growing capital cost of maintenance of the end-of-life facility is the reduced availability of affordable thermal coal supply. A 20 year domestic supply contract was put in place at the time of the privatisation of Eraring back in 2012 but was then unwound in 2013, resulting in a sale price tag of just \$50m, including the Shoalhaven PHS plant thrown in for free.<sup>25</sup>

Origin Energy entered an 8 year coal supply agreement with Centennial Coal ending FY2022. As such, the eightfold price rise of export thermal coal in FY2023 relative to the long term average of US\$70/t caused a massive blowout of Eraring's operating costs. AEMO models a \$99/MWh short run marginal cost of operation at Eraring in FY2023, 4-5 times that of the nearby coal contracted Bayswater coal power plant at A\$22/MWh and eight times the \$14/MWh marginal cost of running the Yallourn lignite power plant in Victoria.

With Origin Energy's exposure to the extreme volatility in coal prices and wholesale electricity prices, and growing global investor pressure to put the company on an accelerated path to decarbonisation, the Board decided spending multiple hundreds of millions on capex to keep the aging plant operational and safe beyond the normal 40 year end of life timeline was not a commercially viable outcome.

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<sup>20</sup> AGL Energy press release, [Liddell's first unit closure marks another major step in AGL's energy transition](#), 1 April 2022

<sup>21</sup> AFR, [AGL bows to shareholders and hastens coal exit](#), 29 September 2022

<sup>22</sup> AFR, [AGL shuts down Liddell coal power station](#), 28 April 2023

<sup>23</sup> AFR, [Origin to close Australia's biggest coal plant early](#), 17 February 2022

<sup>24</sup> AFR, [Delay Eraring closure as 'insurance', says Transgrid's Redman](#), 20 June 2023

<sup>25</sup> NSW Treasurer Mike Baird Press Release, [Government sells Eraring energy to Origin and terminates Cobbora contract](#), 1 July 2013



To keep Eraring open beyond August 2025, Origin Energy would have to source new coal supply at the equivalent of the net back of export spot prices.

Even with Newcastle export 6,000kcal NAR (heating value) grade thermal coal prices having dropped by two-thirds from their peak of US\$445/t at the end of 2022, at the current US\$145/t (A\$216/t) price, this is triple the historical cost of coal supply used to fuel Eraring. NSW coal power plants have been run on long term domestic coal supply contracts at fixed, inflation linked contracts.

**Figure 3.2: Spot Newcastle Thermal Coal Export Prices (6,000kcal NAR)**



Source: [Trading Economics](#)

### 3.3 Vales Point (1,320MW)

The Seven Czech-owned Delta Group now owns the 1,320MW Vales Point coal-fired power plant which is due to close in 2028/29, when it will be an entirely end of life 50-51 years of age. The vested interest lobbying of this group to delay coal power plant closure is constant, and self-serving,<sup>26</sup> but doesn't change the fact that coal plants become increasingly at risk of unplanned catastrophic failure beyond their design life, giving little credible reliability value.

### 3.4 Bayswater (2,640MW)

AGL has slated closure of Bayswater for 2030-2033, which would put the plant at 45-48 years of age. For a coal power plant, Bayswater is flexible, with flexing between minimum and maximum generation of ~1,900MW. Bayswater also has access to a domestic long term coal supply agreement that allows this plant to be run viably till then, absent any price on carbon emissions or any

<sup>26</sup> AFFR, [Coal closures looking 'very, very hard': new Vales Point CEO](#), 27 June 2023

catastrophic failure like those that have afflicted Callide C in Queensland <sup>27</sup> or the Muja AB coal power plant in Western Australia in 2017.<sup>28</sup>

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<sup>27</sup> AFR, [Still no answer to ‘catastrophic failure’ at Callide power station](#), 26 January 2023

<sup>28</sup> The West Australian, [Collie’s Muja AB power station to close in multi-million dollar loss](#), 14 September 2017

## Section 4: Additional Zero Emissions Capacity

*CEF models NSW needs to install 1.1GW pa of new utility scale wind and solar projects through to 2030 to deliver the additional generation capacity needed to replace retiring end-of-life coal power plants. This would see utility scale RE share lift from 27% in 2023 to 35% by 2030.*

Climate Energy Finance models that to accommodate the closure of Eraring over 2025 and Vales Point over 2028/29, coal power's share is forecast to drop from 58.2% in CY2023 (down from 62.4% in CY2022 with the closure of Liddell in April 2023) to 26.5% by CY2030.

Modelling in rooftop solar installs of 1.2GW pa – i.e. assuming no acceleration from the current 100MW per month run rate evident in 2023 (refer Section 5) – utility scale VRE generation of an extra 2,821GWh pa is needed through to 2030; 22,572GWh extra in total.

This would see total RE including rooftop rise from 37.9% in CY2023 (27% excluding rooftop solar) to a 63% share in CY2030 (39% excluding rooftop solar), or ~69% assuming half NSW's electricity imports are solar by 2030. This will bake in permanently lower wholesale and retail electricity costs.<sup>29</sup>

This is conservative, being well below the 82% renewables by 2030 target set by the Federal government for Australia overall, but reflects the coal-heavy starting point in NSW, and lack of progress to date in building out the enabling grid transmission capacity (refer Section 3) and to date limited industry demand response management capacity (refer Section 4).

Hydro generation averaged 2,700GWh over the five years to 2022, and an average share of 3.6%, is included in these figures. We assume this remains flat out to 2030, given Snowy 2.0 is about time-shifting demand, not adding total generation capacity.

An extra 2,821GWh pa of new utility scale VRE would require 1.07GW pa of new wind and solar capacity additions – below the NSW government's target to add 12GW by the end of this decade.

There are certainly enough project proposals in the national pipeline to ensure the above capacity, as AEMO CEO Daniel Westerman highlighted in June 2023, stating there are over 200GW of renewables plus 40GW of storage in the investor pipeline. And AEMO reports it has on the east coast 163 projects comprising 27GW of new generation going through different stages of the connection process.<sup>30</sup>

**Figure 4.1: NSW New Generation Capacity Grid Connection Applications (MW)**

New Utility scale VRE needed	22,572 GWh
2023-2030	8 Years
New Utility scale VRE needed	2,821 GWh pa
Average utilisation rate VRE	30%
Hours pa	8,760 Hours
Average utilisation VRE hours pa	2,628 Hours pa VRE
New Utility scale VRE needed	1.07 GW
New Utility scale VRE needed	1,074 MW pa

<sup>29</sup> Renew Economy, [Record solar generation, from both farms and rooftops, drives down power prices on the NEM](#), 20 April 2023

<sup>30</sup> AEMO, AEMO CEO speech at Australian Energy Week, 20 June 2023

Source: Climate Energy Finance Calculations

We conservatively assume an average 30% capacity factor. We have calculated that ACEN's Stubbo Solar Farm using single-trackers is modelled on a 29% capacity factor, while Squadron's Bango and Sapphire Wind farms assume 35% and 32% respectively (Figure 4.2).

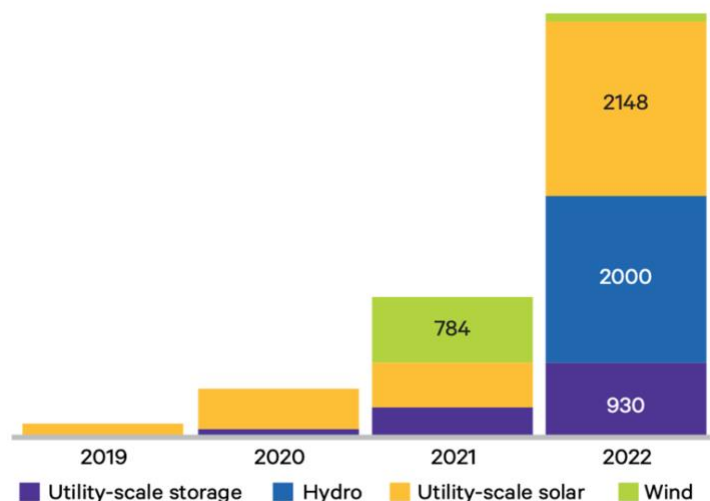
**Figure 4.2: NSW New Generation Capacity Grid Connection Applications (MW)**

<b>Stubbo Solar Farm - ACEN</b>	
Capacity	400 MW
Generation	1,000 GWh
Utilisation rate	29%
Hours pa	8,760 pa
Theoretical	3,504 GWh pa
<b>Bango Wind Farm Yass - Squadron Energy</b>	
Capacity	244 MW
Generation	748 GWh
Utilisation rate	35%
Hours pa	8,760 pa
Theoretical	2,137 GWh pa
<b>Sapphire Wind Farm Yass - Squadron Energy</b>	
Capacity	270 MW
Generation	764 GWh
Utilisation rate	32%
Hours pa	8,760 pa
Theoretical	2,365 GWh pa

Source: Squadron Energy, Climate Energy Finance Calculations

Over the past two years Transgrid has seen a rapid rise in the number of new connection applications across NSW. This will only accelerate with the NSW Government's plans for an additional 12GW of large scale renewable capacity to be connected by the end of this decade.

**Figure 4.3: NSW New Generation Capacity Grid Connection Applications (MW)**



Source: Transgrid Roadmap, June 2023

## 4.1 Utility Scale Renewables

*Australia has no shortage of capital, nor any shortage of new energy project proposals, with 200GW of renewables and 40GW of storage in the pipeline nationally. Our investor profiles (Appendix A) confirm no shortage of capital or project proposals, supporting AEMOs guidance.*

*NSW has over 18GW of wind projects alone in the approvals process and over 9GW of major solar project proposals in train, more than sufficient to deliver on the 1.2GW pa of new utility scale capacity NSW needs. We just need to urgently get these projects to FID and under construction.*

We have identified over 18GW of wind proposals in the EIS or planning pipeline, a number of which could be approved within the next year with a little urgency in the system - Figure 4.4.<sup>31</sup>

**Figure 4.4: NSW Wind Projects In The Pipeline (MW)**

Project	Proponent	Under Construction	Determined	Assessments	Responses	Scoping	Total
Rye Park	Tilt Renewables	396					
Flyers Creek	Iberdrola	132					
Coppabella Wind Farm	Goldwind		275				
Uungula Wind Farm	Squadron Energy		414				
Liverpool Range	Tilt Renewables		1,300				
Capital 2	Iberdrola		144				
Hills of Gold	ENGIE			420			
Bowmans Creek	Arkx Energy			347			
Valley of the winds	ACEN Australia				800		
Thunderbolt	Neoen Energy				380		
Winterbourne	Vestas				700		
Yanco Delta	Virya Energy				1,500		
Spicers Creek	Squadron Energy					700	
Piambong	Vestas					633	
Ruby Hills	WalchaEnergy					860	
Tara Springs	RES Australia					400	
Kerrs Creek	RES Australia					385	
Jeremiah	Squadron Energy					400	
Aquila	ACEN Australia					340	
Burrendong	Arkx Energy					450	
Doughboy	Arkx Energy					300	
Mallee	Spark Renewables					1,000	
Dinawan Energy Hub	Spark Renewables					1,500	
Plains Renewable Energy Park	ENGIE					1,500	
Crookwell 3	GPG					50	
Bullawah Wind Farm	BayWa r.e.					1,000	
Baldon	Goldwind					300	
Burrawong	Windlabs					160	
Ben Bullen	Tetris Energy					150	
Bendemeer	Metis Energy					360	
Euston	DP Energy					330	
Silverton Stage II	AGL Energy					800	
<b>Total MW</b>		<b>528</b>	<b>2,133</b>	<b>767</b>	<b>3,380</b>	<b>11,618</b>	<b>18,426</b>

Source: NSW Major Projects Portal, AEMO Portal,<sup>32</sup> David Leitch June 2023, Company Announcements, CEF Calculations

<sup>31</sup> Renew Economy, [Coal in NSW could be squeezed out by end of decade. But the timelines are tight](#), June 2023

<sup>32</sup> [AEMO Portal](#)

CEF's review of corporate disclosures shows there is over 9,738MW across more than 30 major solar projects in the NSW pipeline, many of which could be accelerated with the right NSW government policy support, including REZ tenders - Figure 4.5. We would encourage the NSW government to upscale the size of their half-yearly tenders with minimum price support, and would recommend the addition of minimum volume offtake for the first five years as well to protect investors against undue curtailment.

**Figure 4.5: Some Major NSW Solar Projects in the Pipeline**

Project	Proponent		Capacity MW
New England Solar Farm - Phase 2	ACEN Australia	Tender Round 1	320
Stubbo Solar Farm	ACEN Australia	Tender Round 1	400
Wollar Solar Farm	Wollar Solar	Construction	280
Sapphire Solar Farm	Squadron Energy	Determination	180
Yarrabee Solar Farm	Origin Energy	Determination	450
Metz Solar Farm	FRV	Determination	115
Yanco Solar Farm	Origin Energy	Determination	60
Walla Walla Solar Farm	FRV	Determination	300
Jindera Solar Farm & BESS	Hanwha Energy Australia	Determination	120
Silverleaf Solar Farm	ENGIE	Determination	120
Springdale Solar	RES	Determination	100
Bomen Solar Phase 2	Spark Renewables	Determination	60
Quorn Park Hybrid	ENEL of Italy	Determination	96
Maryvale Solar & BESS	Gentari / Wirsol	Assessment	230
Darroobalgie Solar Farm	Pacific Blue	Assessment	100
Blind Creek Solar Farm	Octopus Investments	Assessment	350
Birriwa Solar Farm	ACEN Australia	Response to Submissio	600
Wallaroo Solar Farm	New Energy Development	Response to Submissio	100
Dapper Solar Farm	Origin Energy	Preparing EIS	300
Plains Renewable Energy Park	ENGIE	Preparing EIS	400
Monaro Solar Farm	Terrain Solar	Preparing EIS	100
Salisbury Solar Farm	Walcha Energy	Preparing EIS	700
Richmond Valley Solar	Ark Energy	Preparing EIS	412
Dinawan Energy Hub	Spark Renewables	Preparing EIS	1,000
Mates Gully Solar Farm	Spark Renewables	Preparing EIS	160
Wellington North Solar Farm	Lighthouse BP	Preparing EIS	425
Gundry Solar Farm	Lighthouse BP	Preparing EIS	400
Sandy Creek Solar Farm & BESS	Lighthouse BP	Preparing EIS	750
Yass Solar Farm & BESS	ENGIE		80
Buronga energy station	Gentari / Wirsol		400
Yanco Delta Solar	Virya Energy		500
Peninsular Solar Power Station	Edify		130
Total			9,738

Source: Corporate reports, CEF calculations



The more capacity in the NSW system, the better for consumers. With rampant polysilicon and solar module price deflation in 2023, it is reasonable to assume solar tenders could see a record low A\$25-35/MWh in the next few years.<sup>33</sup>

There are suggestions that NSW and Australia more generally can't sufficiently overcome the inertia of the lost decade of climate science and cleantech investment paralysis inflicted under the previous LNP Federal Government. But state governments took the initiative to go it alone without Federal support or coordination. NSW made strong progress developing the planning and regulatory frameworks for rolling out five REZ and the associated grid transmission infrastructure.

There are plans for sufficient grid transmission capacity to add 14GW of new wind and solar projects across NSW, albeit with most of the grid capacity coming onstream towards the end of this decade.

Climate Energy Finance strongly advocates that NSW Energy Minister Penny Sharpe ignore the bluster of the fossil fuel lobbyists advocating for delay, and look at how new VRE capacity can be deployed rapidly, leveraging the existing grid transmission capacity, both in REZs and infill projects elsewhere, and by accelerating deployment of rooftop solar and distributed storage.

February 2023 saw digital modelling by Australian AI-leader [Neara](#) reveal that parts of Essential Energy's distribution network can transport twice as much electricity as Essential Energy had previously indicated, showing engineering safety limits were way too conservative, forcing goldplating of the grid and unnecessarily delaying the electricity grid decarbonisation strategy.<sup>34</sup>

The Clean Energy Regulator (CER) Quarterly Carbon Market Report (QCMR) reveals 432MW of proposed wind and solar power stations reached FID in 1Q2023 (see Figure 6.7), a run rate well below the 4.3GW in 2022. The CER suggests 3-3.5GW total reaching FID in 2023, with momentum expected to accelerate in the second half of 2023, supported by large-scale generation certificates (LGCs) for 2023 of A\$50/MWh, falling to \$30/MWh for 2026.

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<sup>33</sup> CEF, [Solar pivot: A massive global solar boom is disrupting energy markets and speeding the transition](#), June 2023

<sup>34</sup> AFR, [How AI unlocked capacity across NSW's energy grid](#), 22 February 2023

## Section 5. Rooftop Solar

*NSW has over 5.3GW of rooftop solar installed across residential and C&I premises, and in 2023 we are installing a record 100MW per month, double the assumption modelled in AEMO's ISP. The opportunity for smart, co-ordinated virtual power plants (VPPs) to strengthen the grid, deploy distributed capacity quickly and cost-effectively should be the top energy priority of the NSW and Federal Governments.*

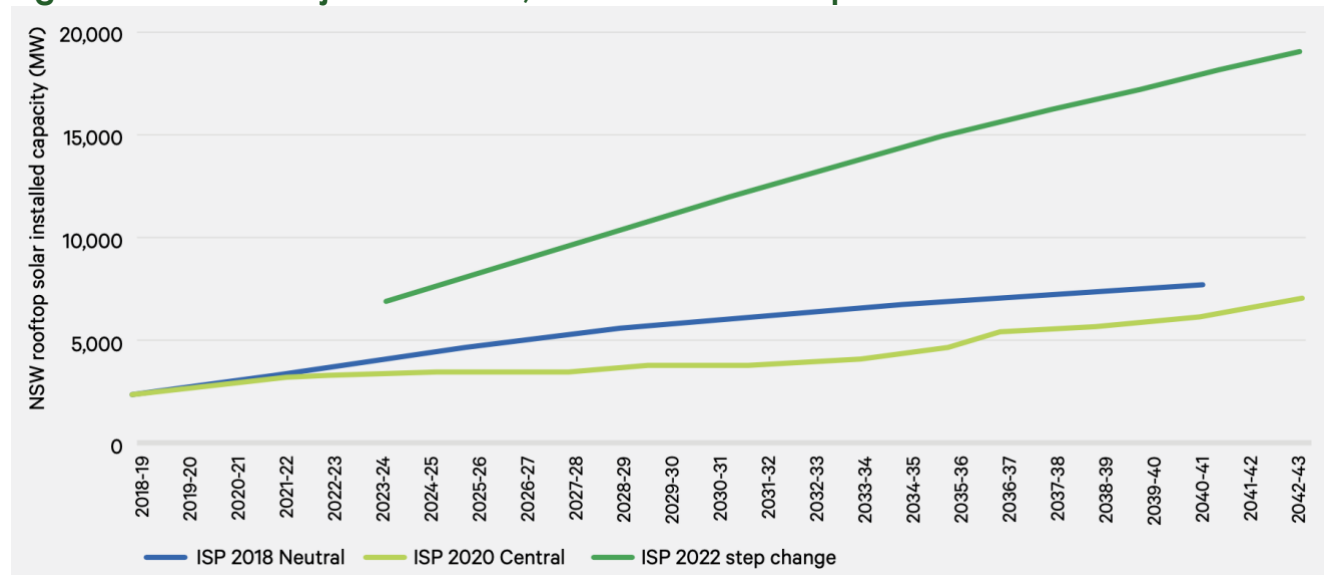
*NSW should target 20GW of rooftop solar by 2030 vs AEMO's 12GW forecast. We conservatively model 1.2GW pa of additions, adding an incremental 1,846GWh pa of distributed generation, which would imply 21TWh pa by 2030, 25% of CEF's forecast NSW electricity demand of 83TWh pa.*

*AEMO models a fivefold increase in Australian rooftop solar by 2050.*

Australia has the highest rooftop solar penetration of any country with 1.2kW per capita at the end of 2022, ranking ahead of Netherlands and Germany.<sup>35</sup> March 2023 saw Australia's cumulative rooftop solar capacity pass the 20GW threshold spanning 3.4 million systems.<sup>36</sup>

The deployment of rooftop solar has outpaced all expectations; one in four Australian homes now have solar on their roof. This growth is expected to continue, with AEMO modelling that 12GW of rooftop solar is projected to be installed in NSW by CY2030, twice the capacity that was projected in 2020 and three times the capacity projected in 2018, as shown in Figure 5.1. NSW installs in 2023 are running at a record 100MW per month, double the assumption modelled in AEMO's ISP. And Australia in 2022 installed 33,000 distributed home storage solutions, showing this too is really starting to take off, and better still, many are Australian made, creating local solutions not dependent on waiting for interstate grid transmissions solutions.<sup>37</sup>

**Figure 5.1 AEMO Projections 2018, 2020 & 2022 Rooftop Solar Growth in NSW Forecasts**



Source: Transgrid Roadmap, June 2023, citing AEMO ISP modelling

<sup>35</sup> Renew Economy, [Australia again tops global solar per capita, as world installs 240GW of PV in 2022](#), 19 April 2023

<sup>36</sup> Renew Economy, [Rooftop solar set to eclipse coal as installations reach more than 20GW](#), 1 March 2023

<sup>37</sup> AFR, [Store solar that sells for cents on power poles near you](#), 11 July 2023

The Australian PV institute reports that as of May 2023, NSW had 864,301 rooftop solar systems installed. Excluding the utility scale systems, there are 759,359 household systems of average 4.59kW capacity, and 104,501 C&I systems of 10-100kW capacity. Total NSW small scale rooftop solar is 5.3GW, with another 4.1GW of utility scale solar installed – Figure 5.2.

**Figure 5.2: Australian solar PV installations – Utility and Rooftop, by State**

<b>NSW - June 2023</b>	<b>Count</b>	<b>MW</b>	<b>Size per facility</b>
Count under 10kW	759,359	3,483	4.59 kW
Count 10-100kW	104,501	1,808	17.30 kW
Over 100kW	441	4,081	9.25 MW
	864,301	9,372	
Penetration	30%		
Generation	CY2023	8,141 GWh	
Hours pa		8760	
Rooftop capacity installed		5,291 MW	
Utilisation rate implied		17.6%	

Source: APVI, [Mapping Australian Photovoltaic installations](#), Accessed June 2023, CEF calculations

Average residential solar PV system prices in June 2023 are A\$1.10/W after subsidies, dropping to A\$0.90/W for a 10kW residential system, a 20% scale cost advantage vs a 3kW system. A similar 100kW commercial system costs \$0.85/kW, or around \$1.55/W on average without small-scale technology certificate (STC) support.

Installed capital prices have recently increased marginally since the start of 2021 due to growing international demand creating supply chain bottlenecks, but CEF forecasts this will progressively drop, given the likely 10% annual solar module price declines over the rest of this decade.<sup>38</sup>

**Figure 5.3: NSW Rooftop Residential Solar Choice Installed Capital Cost Index**



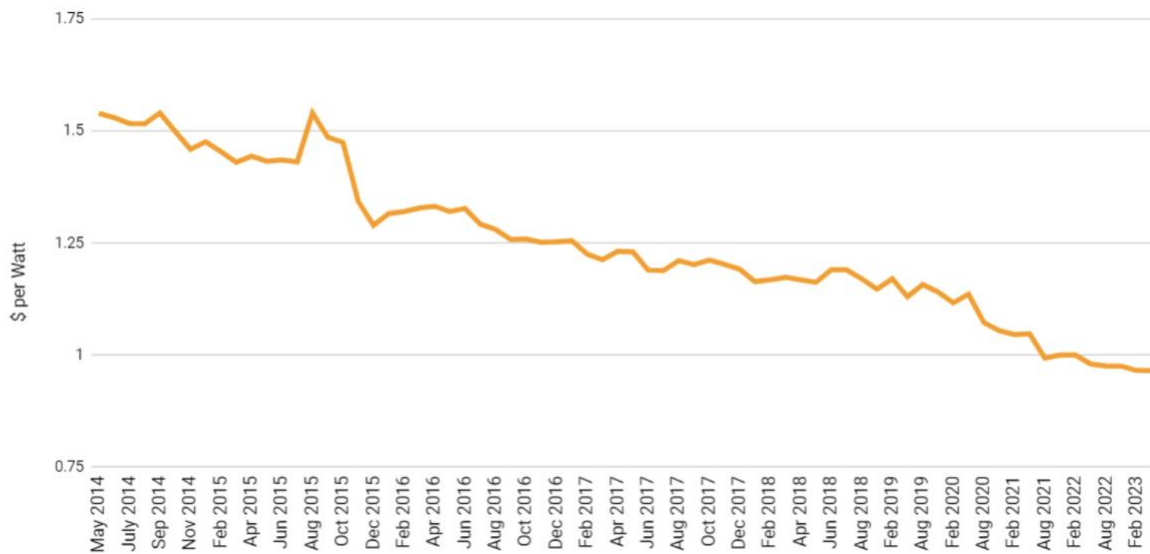
<sup>38</sup> CEF, [Solar pivot: A massive global solar boom is disrupting energy markets and speeding the transition](#), June 2023

Source: *Solar Choice*

The average system size in the sub-100kW market grew further to over 9kW/system, reflecting both the growth in commercial installations, and the growth in the typical size of residential systems, as householders prepare their homes for future addition of batteries and EVs.

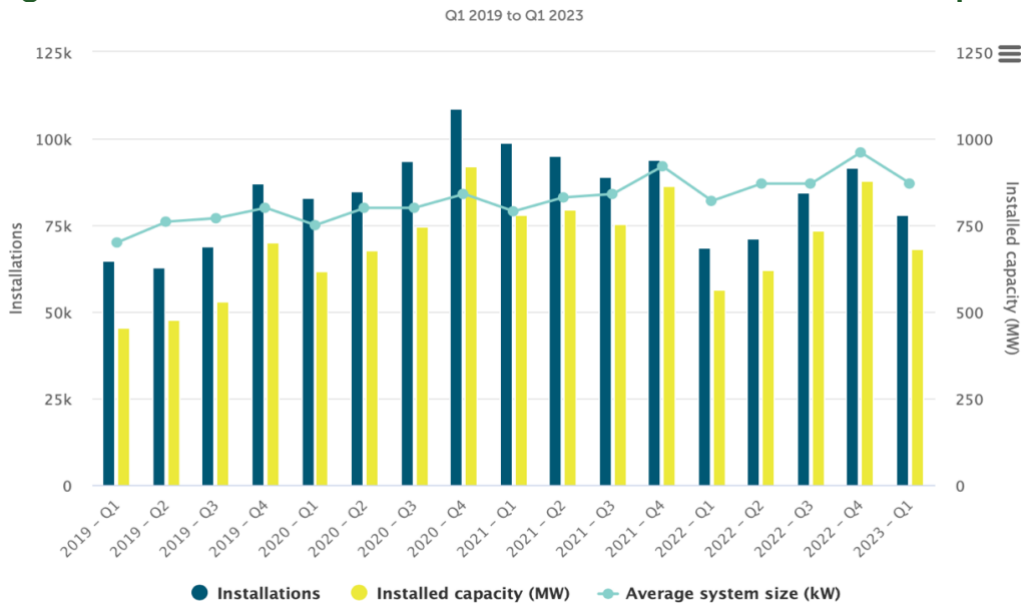
Australia's high electricity prices and inexpensive PV systems means payback can commonly be achieved in 3-5 years. Commercial PV deployment continues to grow and corporate interest in solar power purchasing agreements (PPA) is building, and the capital cost has continued to decline 5-10% annually since 2014 – Figure 5.4.

**Figure 5.4: Australian C&I Solar Choice Installed Capital Cost Index (\$/W)**



Source: *Solar Choice*

**Figure 5.5: National Small Scale Solar installations, Installed Capacity, and system size**

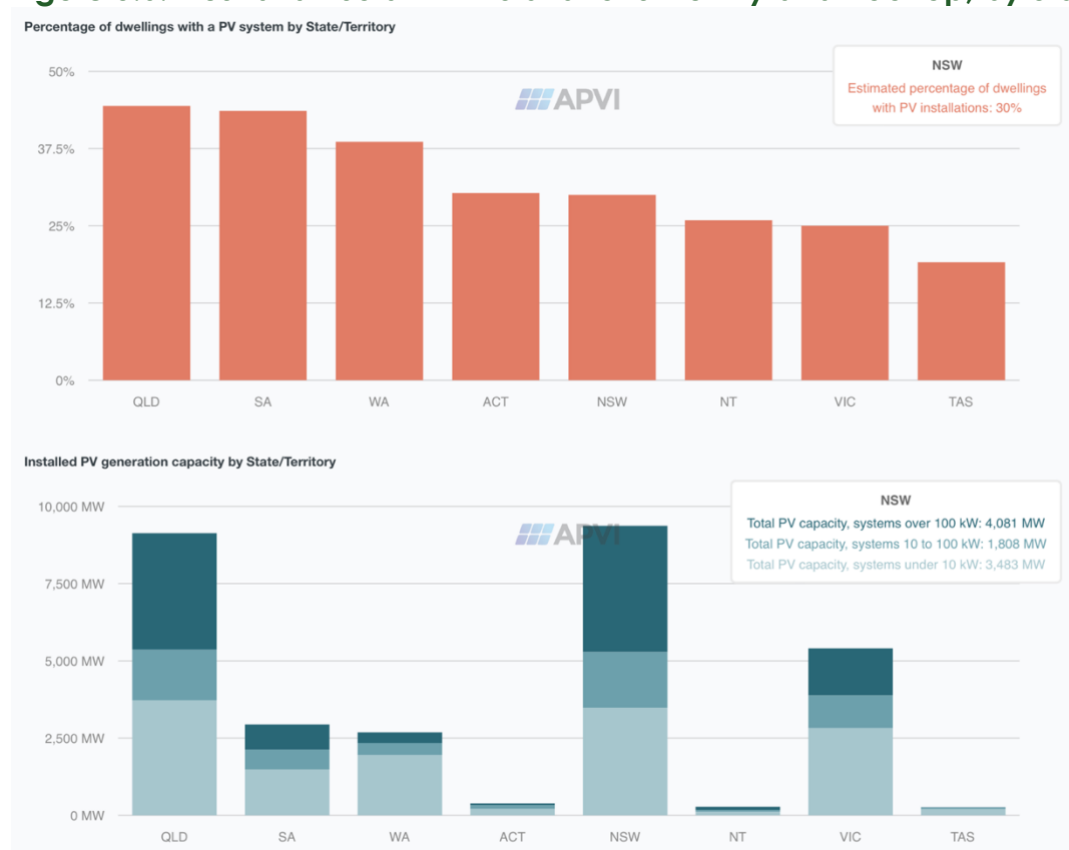


Source: *Clean Energy Regulator, Small-scale technology certificates (STCs), March 2023 Quarter report*

Nationally, Australia’s installed rooftop solar PV capacity for 1Q2023 was 681MW (see Figure 5.5). An estimated 80,300 rooftop solar PV systems with an average system size of 8.7kW were installed. The CER forecasts 3.0GW nationally in 2023.

NSW needs to take advantage of the power of distributed energy resources (DER) so as to avoid the constraints of grid congestion. The NSW government should mandate Transgrid, Endeavour Energy and Ausgrid to identify where the local grid has capacity and target rooftop solar there.

**Figure 5.6: Australian solar PV installations – Utility and Rooftop, by State**



Source: APVI, *Mapping Australian Photovoltaic installations*, Accessed June 2023

Origin Energy and AGL are both building out VPPs to centrally manage the distributed energy resources of customers with rooftop solar, and increasingly batteries, with batteries on wheels (EVs) to come. In February 2023 Origin reported its VPP had grown to 449MW under management, up significantly from 258MW six months earlier. And Spike demand response had grown to 85,000 customers, all seeking some respite from energy poverty inflicted by fossil fuel hyperinflation.<sup>39</sup> Central management of this critically important new resource needs to be accelerated and incentivised.

<sup>39</sup> Origin Energy, [Half Year Investor Presentation](#), 16 February 2023

## 5.1 School rooftops, public buildings and C&I VPPs

*NSW needs to accelerate rooftop solar deployments, and develop every public building in NSW as a VPP with rooftop solar, battery storage, ground heat pumps, EV charging and demand response management. This is a 'no brainer' for both speedy RE deployment and massive scale procurement to drive down the capital costs, establish the supply chains and build out the professional workforce needed.*

*This program could see 2GW of rooftop solar and 7GWh of BESS on NSW schools alone, a massive VPP.*

*CEF also recommends NSW lobby the Federal government to immediately lift the SRES from a limit of 100kW to 1.0MW to rapidly scale up the C&I VPP market.*

### **Schools**

November 2022 saw the previous government announce the NSW Smart Energy Schools Pilot project, to harness the solar generation potential of up to eight million square metres of roof space on 21,700 buildings across 2,200 public schools. The expressions of interest (EOI) process, which forms part of Stage 3 of the pilot, will seek proposals to finance, install and operate solar and battery systems across the state's remaining public schools, potentially as part of a long-term PPAs. The potential is huge, given NSW public schools consume 345GWh pa of electricity, 1.1% of NSW's total electricity demand.<sup>40</sup>

School Infrastructure NSW is inviting specialist companies to register for the pilot program in what is believed to be one of the largest procurement exercises of its kind in Australia.

May 2022 saw Stage 1 of the Smart Energy Schools Pilot Project – solar and battery storage systems capable of storing 950kWh of electricity paired with 3,200kWh of battery storage – installed alongside air conditioning systems with smart controls at 24 schools.<sup>41</sup> These systems have been switched on and are cutting electricity emissions by an average of 30% and electricity costs by more than \$14,000 each month.

Work was underway on another 29 schools as of November 2022 for stage 2 of the pilot program. Additionally, 7 schools that had solar and battery systems installed as part of the Smart Batteries for Key Government Buildings initiative will also take part in the pilot. The project is testing solar and battery energy storage systems at 60 schools across the state and the feasibility of operating them as part of a VPP. The smart controls, in particular, will investigate the potential use of demand response controls to reduce the schools' peak demand and avoid costly upgrades to the electricity network.

NSW now needs to move rapidly and provide clear long term signals to our SMEs to invest in capacity, including electrical apprentices. The 2,200 public school systems with 0.95MW of solar and 3.2MWh of BESS would create a pipeline of 2.1GW of rooftop solar (a 40% uplift on all 5.2GW rooftop solar installed to-date in the last decade in NSW) and 7GWh of batteries, which is a 14-fold increase in the total installed utility scale batteries in operation across NSW today.

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<sup>40</sup> Renew Economy, [NSW plans massive solar and battery VPP across 2,200 public schools](#), 16 November 2022

<sup>41</sup> One Step off the Grid, [School-based solar and battery virtual power plant pilot kicks off in NSW](#), 19 May 2022



### ***Council infrastructure***

Beyond public schools, the NSW should work in collaboration with the Federal Government on its \$100m May 2023 commitment to the Community Energy Upgrades Fund to co-fund upgrades with local councils. This new funding will unlock energy savings by replacing energy-intensive heating in council pools with heat pumps, and installing energy efficient lighting and battery storage at sporting fields, libraries and community centres.<sup>42</sup>

### ***Community housing***

Beyond this, social housing,<sup>43</sup> aged care facilities, defence housing and low income housing are all avenues to deploy VPPs rapidly, with a likely improvement in the grid transmission system strength, and no major infrastructure project delays.

### ***Commercial and Industrial Sector***

Additionally, the Commercial and Industrial (C&I) sector should be given a stimulus to deploy RE and energy efficiency upgrades.. The NSW government should immediately work with the Federal government to lift the Clean Energy Regulator's 100kW cap for the small scale renewable energy scheme (SRES) applying to rooftop solar, solar water heaters and air source heat pumps, to 1.0MW, so that this low cost, high value, zero emissions capacity can be lifted fiftyfold by 2030.<sup>44</sup>

Extending the SRES program beyond 2030 for new installations would be a logical concurrent development. We recommend the NSW government work with electricians and building suppliers on rollout of the enhanced SRES, as well as advertise to build awareness of this scheme.

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<sup>42</sup> Prime Minister of Australia, [Media Release](#), 16 June 2023

<sup>43</sup> APVI, [Solar Potential of Australian Social Housing Stock](#), 2 Feb 2022

<sup>44</sup> Australian Government, Clean Energy Regulator, [Small-scale Renewable Energy Scheme](#), 14 April 2023

## 5.2 Behind the Meter Storage

Behind the meter energy system storage has been long talked about as a key complement to rooftop solar and EVs, improving grid system strength and providing flexible peak power supply.

Germany leads the world in distributed BESS, with 1HCY2023 seeing 240,000 units installed.<sup>45</sup>

The Australian storage market remained strong in 2022, with the CER now tracking and reporting battery installations. Over 19, 000 new batteries were installed with rooftop solar in 2022 nationally, increasing the total batteries installed to 60,000 by the end of 2022.

Victoria's June 2023 budget provided \$42m to support 100 neighbourhood batteries to allow 25,000 households to access local storage, plus \$16m in zero interest loans for Solar Home batteries.<sup>46</sup>

**Figure 5.7: Solar Battery Capital Cost Index (\$/W)**



Source: [Solar Choice](#)

**Figure 5.8: Average out-of-pocket battery installation prices – May 2023**

Battery Size	Battery Only Price*	Battery + Inverter/Charger**
3kWh	\$4,260	\$4,770
8kWh	\$10,080	\$11,120
13kWh	\$16,380	\$17,680
18kWh	\$23,940	\$25,920

\*Includes the installation of the battery only. You must already have a hybrid/battery ready system

\*\*Includes an additional inverter to manage the battery bank for a DC-coupled battery system

Source: [Solar Choice](#)

Solar Choice estimates the May 2023 capital cost has an implied cost per kWh throughput of \$0.36/kW assuming only one cycling per day.

<sup>45</sup> Renew Economy, [New battery gigafactory in works for German energy storage giant](#), 16 June 2023

<sup>46</sup> Victorian Government, [Public Accounts and Estimates Committee 2023-24 Budget Estimates Hearing](#), 8 June 2023

Accelerated distributed storage, like Ausgrid's new power pole mounted batteries,<sup>47</sup> community batteries, and incentives for behind the meter storage should be explored.

NSW should establish a new residential behind the meter residential solar and storage incentive program (ideally via unsecured loans from the CEFC), with a monthly cap to the program to ensure a steady flow of work for electricians and avoid the solarcoaster.

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<sup>47</sup> Renew Economy, [Ausgrid installs its first power pole-mounted batteries in NSW](#), 5 July 2023

## 5.3 The Solar Duck Curve

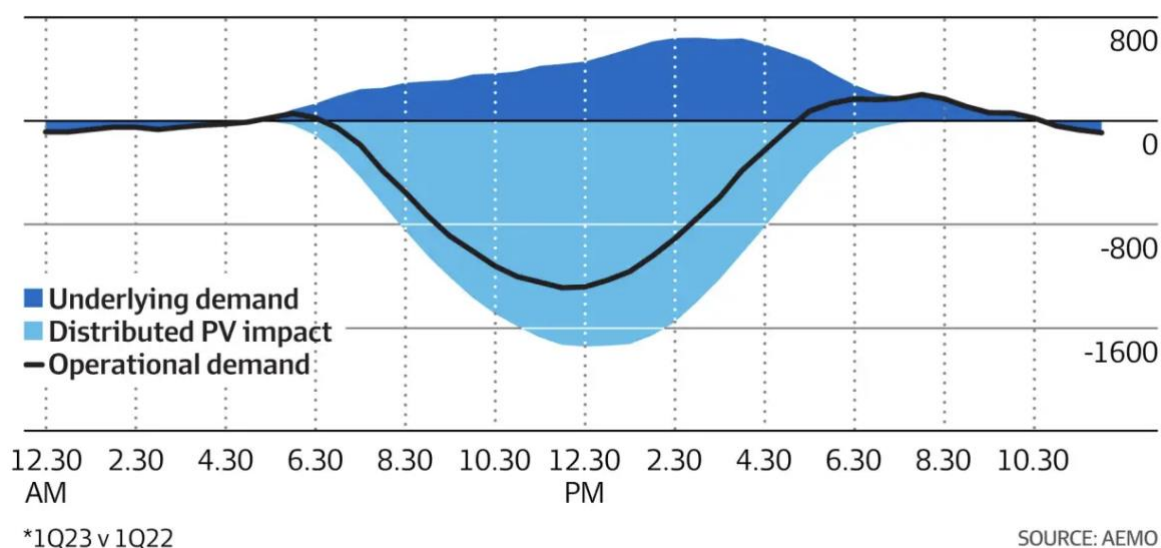
*NSW needs to embrace the benefits of rapidly deployable, zero emissions, distributed, low cost solar generation, and also the implications of this in terms of much more grid firming capacity, and the need to embrace load-following technologies e.g. heating hot water during the day, and the extra value of batteries on wheels (EVs) to time-shift excess generation into the evening peak.*

For many years the electricity generation sector has been warned of the disruptive influence of solar generation, which entirely predictably follows the sun. And with Australia's heavy penetration of behind the meter rooftop solar, the disruption is even more stark. Ongrid electricity demand falls daily during the 9am-5pm period, and most visibly during 10-3pm. This guts the demand and hence economic viability of traditional inflexible coal-fired power generation (particularly for end-of-life coal plants), as it would for nuclear. The grid generation system of last century is not able to cope with the zero marginal cost solar generation that occurs for a third of each 24 hour cycle.

The second implication is the rising need for peaking power generation. Traditionally that was thought to be expensive peaking methane gas power plants (AEMO estimates by 2030 this LCOE at A\$175-250/MW<sup>48</sup> without including any carbon emissions costs). This is rapidly being challenged by batteries of 1-2 hours storage duration, with 4-8 hours duration being increasingly competitive. The US Energy Information Administration (EIA) models that for new firming generation entering service in 2028, batteries at US\$117/MWh are 10% cheaper for grid firming than peaking gas at US\$129/MWh,<sup>49</sup> even absent a price on carbon emissions, and allowing for much lower methane gas prices in the US, given the absence of the multinational gas cartel gouging present in Eastern Australia.

**Figure 5.9: Solar is Predictable, and Concurrent with other Solar, Requiring New Thinking**

Changes in average NEM demand components by time of day\* (MW)



Source: AEMO, [AFR](#)

<sup>48</sup> AEMO [Current inputs, assumptions and scenarios](#), December 2022

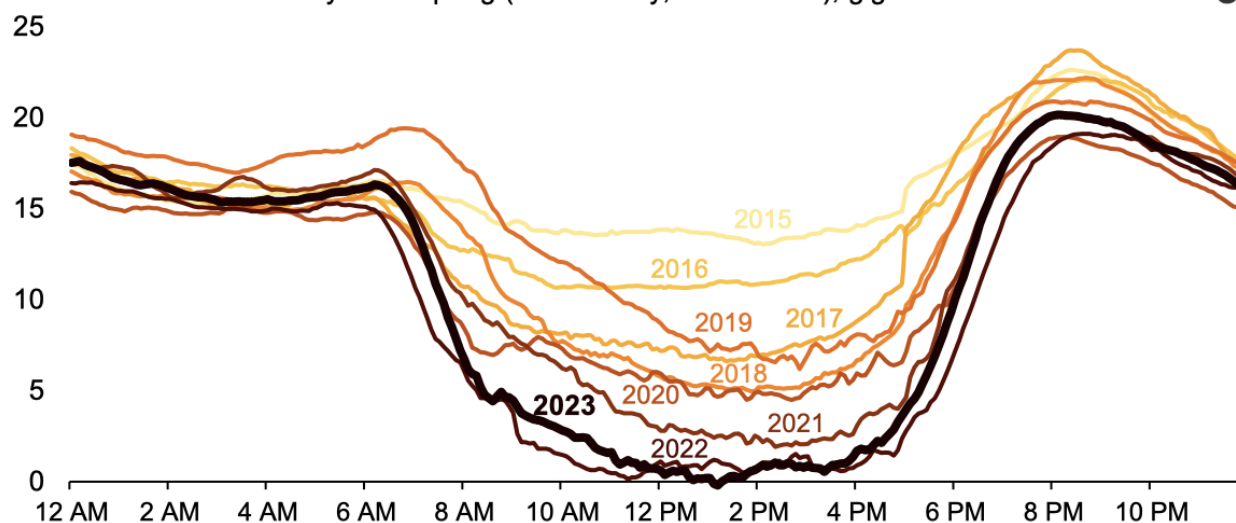
<sup>49</sup> US Energy Information Administration, [Levelized Costs of New Generation Resources in the Annual Energy Outlook 2023](#)

Figure 5.9 details the solar duck curve evident in Australia in 1QCY2023 relative to one year earlier. Figure 5.10 details the extent of the solar duck curve evident in California from 2015-2023.

## Figure 5.10: California Shows that as Solar Capacity Grows, the Duck Curve Deepens

### California's duck curve is getting deeper

CAISO lowest net load day each spring (March–May, 2015–2023), gigawatts



Source: US EIA, *As solar capacity grows, duck curves are getting deeper in California*, 21 June 2023

CEF would note that with global battery investments doubling from US\$10bn in 2021 to US\$20bn in 2022 and then another near doubling to US\$37bn in 2023 (Figure 8.1), economies of scale, technology improvements and now falling commodity prices means battery firming costs will continue to fall by double digits annually over the coming decade.

The logical conclusion is Australia needs more load following demand. This has many obvious implications, for example, heating hot water systems during the day using surplus solar generation, not in the middle of the night using coal fired power generation, as well as improving house and office insulation and mandating double glazing so that buildings can be pre-heated or pre-cooled. Key to this is leveraging the power of batteries-on-wheels (EVs), charging while connected to the grid during the day with near-zero-cost solar (e.g. putting charging in at all railway and Bunnings carparks), so as to demand-shift for supply into the evening peak.

There are immediate and easy ways to capitalise on the near-zero cost electricity increasingly available in the middle of the day.

WA has proposed a Community Energy program to provide households undergoing ongoing financial difficulties with free electricity between 9am and 3pm.<sup>50</sup>

The Institute for Sustainable Futures has proposed to move residential water heating till middle of the day, rather than middle of the night, to move from coal to solar power, and to leverage their flexible operation for load shifting. Simple and easy, with a rule change.<sup>51</sup>

<sup>50</sup> Renew Economy, [WA to use solar duck to give free power to state's households "doing it tough"](#), 11 July 2023

<sup>51</sup> Institute for Sustainable Futures, [Domestic Hot Water and Flexibility](#), 5 June 2023

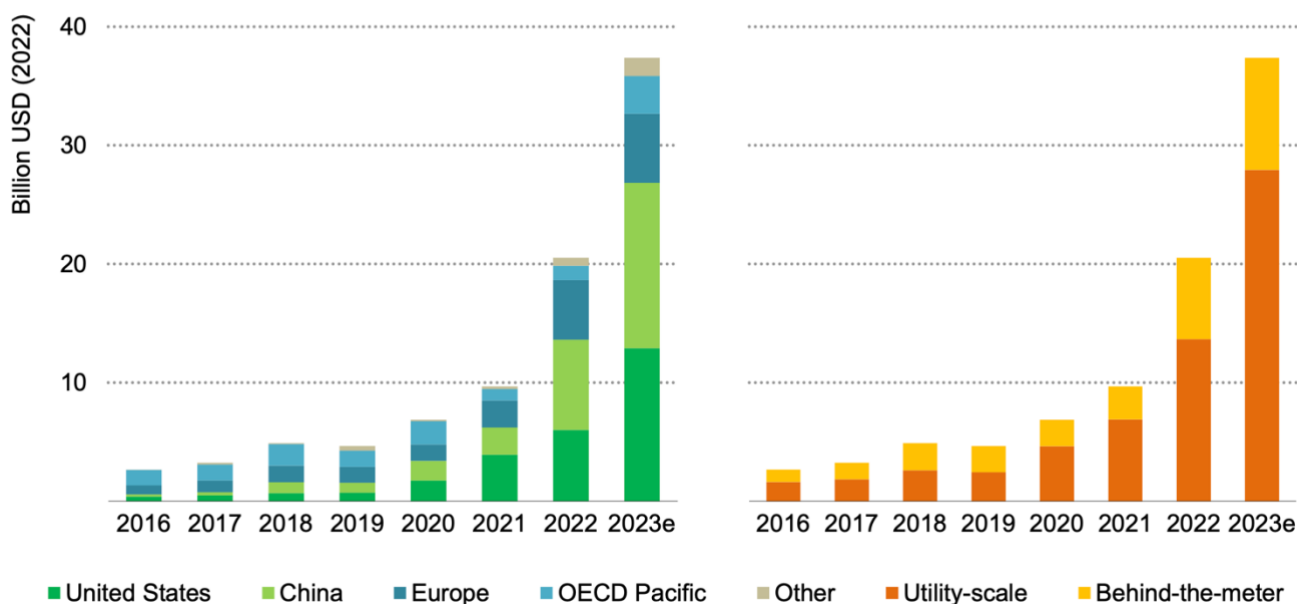
## Section 6: Solutions for Grid Firming: Batteries

*The global investment in battery manufacturing capacity and battery installations is booming, growing far faster than any thought possible even just one year ago. Global battery investments doubled in 2022, and are on track to nearly double again in 2023. Double digit annual cost deflation is likely over the coming decade, like solar. Fast to deploy, batteries will play the key role in grid firming and time-shifting ever cheaper solar generation. Australia needs to roll out its Capacity Investment Scheme at speed and scale.*

CEF notes that the IEA models that global battery investments doubled from US\$10bn in 2021 to US\$20bn in 2022 and are on track for another near doubling to US\$37bn in 2023 (Figure 6.1), with economies of scale, technology improvements and now falling commodity prices meaning battery firming costs will continue to fall by double digits annually over the coming decade.

**Figure 6.1: Global Investment in Battery Storage is Set for Rapid Growth in 2023**

Battery storage investment by geography (left) and segment (right), 2016-2023e



Source: IEA calculations based on Clean Horizon (2023), BNEF (2023) China Energy Storage Alliance (2023)

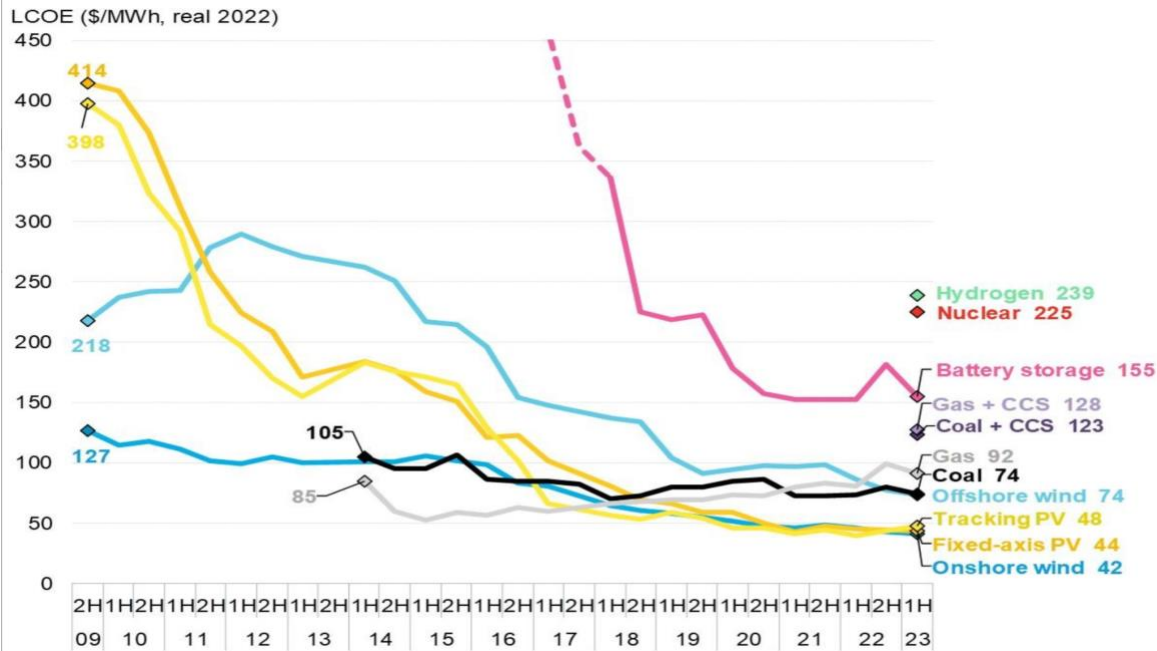
As a result, battery price deflation is entirely predictably going to return to the double digit annual reductions seen over the last decade - Figure 6.2.

Battery manufacturing capacity is expanding exponentially in 2023, underpinned by the landmark US decarbonisation investment initiative, the Inflation Reduction Act (IRA) and the investment / trade / technology race this has opened up against China's domination of the global battery supply chain. In the space of 15 months, the IEA tracks that global battery manufacturing capacity plans by 2030 have expanded from just 11% of the required capacity to deliver on the Net Zero Emissions Scenario trajectory to 97% by the end of 1QCY2023 – Figure 8.3. And rather than being solely short duration, longer timeframes are increasingly competitive, including a proposed 100 hour battery in the US.<sup>52</sup>

<sup>52</sup> Renew Economy, [Billionaire-backed 100-hour iron-air battery gets go ahead to help replace coal](#), 10 July 2023

Six of the top 10 battery manufacturing firms globally are Chinese. June 2023 saw the US Department of Energy Loan Office Program extend a US\$9.2bn loan to BlueOval SK, a joint venture owned by Ford Motor Co. and South Korean battery giant SK On Co. in support of the construction of three battery factories to add 120GWh pa of new battery capacity.<sup>53</sup> More than 100 battery and electric-vehicle production projects are announced or already under construction in the US, representing about \$200 billion in total investments.<sup>54</sup> This is a global gamechanger that means grid firming is going to be dominated by batteries.

**Chart 6.2: Solar LCOE is now the disruptive low-cost source of new electricity**



Source: Bloomberg NEF

**Chart 6.3: Global Cleantech Manufacturing Capacity Expansions (2021 to 1Q2023)**

	2021	2022	Announced as of late 2022	Announced as of end-1Q 2023
Solar PV	29%	40%	103%	165'
Batteries	6	11	78	97
Electrolyzers	4	5	46	57
Heat pumps	25	30	39	42
Wind	24	25	29	29

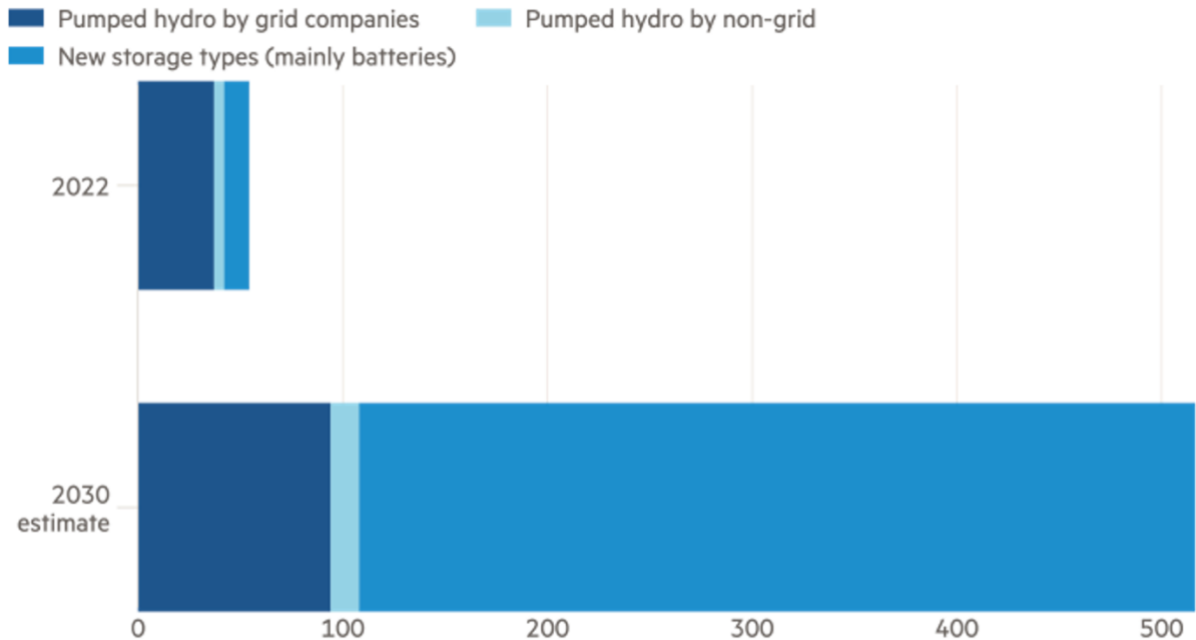
Note: Installed and announced manufacturing capacity, relative to 2030 levels needed in the IEA NZE scenario  
Source: IEA The State of Clean Technology Manufacturing, May 2023, Bloomberg

<sup>53</sup> Bloomberg, Transcript: A \$9 Billion Deal to Supercharge US Cleantech, 22 June 2023  
<sup>54</sup> Bloomberg, Ford Gets \$9.2 Billion to Help US Catch Up With China's EV Dominance, 22 June 2023



Chart 6.4 details Goldman Sachs’ forecast that electricity storage in China will grow 70-fold this decade, adding 410GW of battery storage, even as the country trebles its PHS capacity to a world leading 90GW.

**Chart 6.4: China’s Energy Storage is Expected to grow 70-fold this Decade (GW)**



Source: Goldman Sachs, [FT](#) 28 June 2023

**What is a grid forming battery?**

CEF is a financial analysis thinktank, and does not profess to provide engineering advice. Transgrid’s June 2023 Roadmap provides a good overview of how grid forming batteries hold significant promise for both inertia and system strength support, in addition to other value streams they are already known to offer.

Through its Wallgrove Grid Battery project, Transgrid is already trialling the use of a 50MW/75MWh lithium-ion battery to provide synthetic inertia services to the NSW transmission network – the ability of a generator to sense and respond to system frequency changes. The Hornsdale Power Reserve in South Australia also provides synthetic inertia, and the Torrens Island battery is currently the largest grid forming battery in the world. While Transgrid warns grid forming batteries are yet to be field-tested for system strength provision, initial analysis indicates that this technology could make a positive contribution.<sup>55</sup>

ARENA is supporting eight grid-forming battery projects, with a combined capacity of 2GW.

ARENA and industry are also exploring cost-effective pathways to shut down the boilers at coal-fired power stations and convert the generator and supporting infrastructure into a synchronous condenser to provide much needed stability services back into the power system.

<sup>55</sup> Transgrid, [Transgrid Roadmap to secure grid in the clean energy transition](#), 21 June 2023

There are more than 10GW / 31GWh of new BESS proposals announced in the development pipeline across NSW – Chart 6.5 (here are so many proposals this list is not comprehensive). BESS can be built anywhere the existing grid needs reinforcing, can be built at speed and scale, and is immensely modular., This is a key opportunity for accelerating the energy transition in NSW. – [Chart 6.5: Major BESS Proposals in NSW \(MW/MWh\)](#)

Project	Proponent	Colocated VRE capacity	Capacity		Hours
			MW	MWh	
Big Canberra Battery	Macquarie Group's Eku & Shell	n.a.	250	500	2.0
Blind Creek Solar & BESS	Octopus Investments	350	300	600	2.0
Broken Hill BESS	AGL Energy	n.a.	50	50	1.0
Calala BESS	Equis	n.a.	300	1,200	4.0
Capital Battery - Canberra	Neoen	n.a.	100	200	2.0
Dinawan Energy Hub	Spark Infrastructure	2,500	500	1,000	2.0
Eraring BESS	Origin Energy	n.a.	460	920	2.0
Eraring BESS - Phase 2	Origin Energy	n.a.	240	2,800	4.0
Eraring BESS - Phase 3	Origin Energy / Allegro Energy	n.a.	5	60	12.0
Forest Glen Solar Farm	Brookfield's X-Elío	90	25	25	1.0
Golburn River Solar & BESS	Lighthouse BP	550	260	520	2.0
Great Western BESS	Neoen	n.a.	500	1,000	2.0
Jindera Solar Farm & BESS	Hanwha Energy Australia	120	30	60	2.0
Liddell BESS	AGL Energy	n.a.	500	2,000	4.0
Limondale Solar + BESS	RWE Renewables of Germany	249	50	400	8.0
Mallee Wind Farm	Spark Infrastructure	1,000	350	700	2.0
Maryvale Solar & BESS	Gentari	230	125	375	3.0
Mates Gully Energy Hub	Spark Infrastructure	160	150	300	2.0
Merriwa Solar Hub	GMR	550	400	1,600	4.0
Monaro Solar Farm	Terrain Solar	100	40	40	1.0
Mt Piper BESS	EnergyAustralia	n.a.	500	2,000	4.0
New England Solar BESS	ACEN Australia	720	200	400	2.0
New England Solar BESS - Phase 3	ACEN Australia	n.a.	1,200	2,400	2.0
Orana BESS	BlackRock's Akaysha Energy	n.a.	200	1,600	8.0
Peninsular Solar Power Station	Edify	130	100	100	1.0
Plains Renewable Energy Park	ENGIE	1,900	400	1,600	4.0
Quorn Park Hybrid Project	Enel	96	20	40	2.0
Riverina & Darlington Point	Edify / Federation Asset Mgmt	333	150	300	2.0
Sapphire Wind Farm	Squadron Energy	270	30	30	1.0
Silver City Energy Storage Centre	Energy Estates / Hydrostar		200	1,550	7.8
Tomago BESS	AGL Energy	n.a.	500	2,000	4.0
Wallerawang 9 Battery	Shell Energy	n.a.	500	1,000	2.0
Waratah Super Battery	BlackRock's Akaysha Energy	n.a.	850	1,680	2.0
Wattyl Creek Energy Hub	Spark Infrastructure	500	350	700	2.0
Wellington BESS	Shell Energy & AMPYR Aust.	n.a.	500	1,000	2.0
Yanco Delta Wind & Solar Farm	Virya Energy	1,800	500	500	1.0
<b>Total</b>			<b>10,835</b>	<b>31,250</b>	

Source: Company Accounts, Climate Energy Finance calculations

## 6.1: Major NSW Battery Developments

NSW currently has four utility scale batteries in operation: the 125MW/250MWh Riverina BESS; the 50MW Wallgrove BESS; the 25MW/50MWh Darlington Point BESS; and the 10MW Queanbeyan BESS.

There is a massive scaling up of BESS developments in Australia, supported by the rapid closure of coal fired power plants and the need to firm up low cost but intermittent renewable energy. Deployed at speed and very scalable, BESS provide a perfect immediate complement to long-dated but slow to deploy transmission infrastructure.

The Federal Government is supporting zero emissions firming solutions with its Capacity Investment Scheme (refer section 10), building on existing momentum that is seeing new battery announcements almost weekly around Australia. Many are located at coal power plant sites, leveraging the existing grid infrastructure and land. For example June 2023 saw ENGIE & Macquarie's Eku 150MW/150MWh Hazelwood BESS commissioned, with scope for this to expand ten-fold as battery prices come down given there is 1,600MW of transmission connection capacity now idle.

May 2023 saw confirmation AGL's new 250MW / 250MWh Torrens Island BESS in SA is readying for commissioning, one of the biggest operating today in the world, but soon to be well overtaken.<sup>56</sup>

In June 2023 Neoen announced plans for a 1GW / 4GWh Collie BESS in WA,<sup>57</sup> adding to the May 2023 announcement by Synergy WA of the commissioning of its 100MW/200MWh BESS at Kwinana, and plans to add a 200MW/800MWh BESS at Kwinana, both at retired coal fired power plant sites.<sup>58</sup>

June 2023 saw the commissioning of Genex Power's 50MW/100MWh Bouldercombe BESS near Rockhampton in Queensland, on time and on budget.<sup>59</sup>

This massive upsurge comes at a time when vested interests are clearly running a fact-free fear campaign to prolong NSW's reliance on thermal power, despite the overwhelming speed of energy transition underway.<sup>60</sup>

We outline below a number of recent new battery developments across NSW, a space upscaling so fast it is nearly impossible to keep track.

### **Waratah Super Battery (WSB) 850MW / 1,680MWh**

The NSW government has awarded the \$910m Waratah Super Battery, with a planned capacity upgrade to a 850MW / 1680MWh size.<sup>61</sup> The WSB project will be developed within the former Munmorah Power Station site, 25km south of the Eraring power station.

October 2022 saw Akaysha Energy appointed by the Energy Corporation of NSW (EnergyCo NSW) System Integrity Protection Scheme (SIPS) Service Provider to deliver on this project.<sup>62</sup> In February

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<sup>56</sup> Renew Economy, [Big batteries "cannibalising" gas plants, says AGL, as Torrens BESS charges up](#), 19 May 2023

<sup>57</sup> Neoen press release, [Neoen to build its first long duration battery after winning a 197 MW contract in WA](#), 19 June 2023

<sup>58</sup> Synergy press release, [Synergy's big battery ready, bigger battery planned](#), 18 May 2023

<sup>59</sup> Renew Economy, [Genex switches on its first big battery project on time and on budget](#), 28 June 2023

<sup>60</sup> AFR, [Coal closures looking 'very, very hard': new Vales Point CEO](#), 27 June 2023

<sup>61</sup> NSW Government Energy Co, [Waratah Super Battery](#)

<sup>62</sup> Akaysha, [Waratah Super Battery](#)

2023, the NSW Government granted planning approval for the construction and operation of the WSB,<sup>63</sup> and construction began in May 2023.

The WSB also expands grid capacity for utility scale renewables by an extra 900MW under SIPS.

### **Origin Energy's Eraring Power Station BESS 700MW / 2,800MWh**

Origin is progressing plans for a BESS at its [Eraring Power Station](#). April 2023 saw Origin confirm its FID on a \$600m investment to develop the Phase 1 460MW 2-hour Eraring battery with construction due to commence July 2023, anticipated to come online in 4QCY2025.<sup>64</sup>

The proposed battery could subsequently be expanded to 700MW for up to 4 hours. Locating the battery at Eraring takes advantage of the existing transmission and grid connection infrastructure, minimising the need for construction of long transmission lines.

### **Federation Asset Management's 150MW / 300MWh Riverina & Darlington Point BESS**

May 2022 saw Federation acquire a majority stake from [Edify Energy](#) in the now operating, co-located Riverina and Darlington Point BESS, in total a combined 150MW/300MWh.

### **ACEN's New England NSW 1.4GW / 2.8GWh BESS**

In May 2023 ACEN Australia received approval to expand its proposed New England NSW 1.4GW / 2.8GWh Battery. This proposal was upgraded from the original approved 200MW, two-hour proposal. The battery is being built alongside ACEN's huge 720MW New England solar farm (where phase 1 is already operational).

ACEN also has the [400MW Stubbo Solar and 200MWh BESS Project](#) in the Central West Orana REZ.

### **RWE Renewables of Germany 50MW / 400MW BESS**

[RWE](#) won a [50MW/400MW BESS](#) allocation in the Round 1 LTESA Tender of the NSW Government in May 2023, to be co-located with RWE's [249MW Limondale solar farm](#) at Balranald, NSW.<sup>65</sup>

### **BlackRock's Akaysha Energy 200MW / 1,600MWh Orana BESS**

Akaysha Energy has a number of battery proposals, including the [Orana BESS](#) at Wellington with a proposed capacity of between 200-400MW and providing up to 8 hours or 1,600MWh of energy storage, delivered in up to two stages to support capacity in the Central-Orana REZ.<sup>66</sup>

### **Equis Australia Calala 300MW / 1,200MWh BESS**

The proposed Calala 300MW / 1,200MWh BESS is located 6km southeast of Tamworth.<sup>67</sup>

### **Energy Australia 500MW / 2,000MWh Mt Piper BESS**

Energy Australia's [500MW 4-hour Mt Piper BESS](#) is proposed at the existing Mt Piper coal plant.

### **Octopus Investments Blind Creek Solar and 300MW / 600MWh BESS**

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<sup>63</sup> NSW Government Energy Co, [Waratah Super Battery planning approval bolsters secure energy future for NSW](#)

<sup>64</sup> Origin Energy, [Origin acquires interest in Newcastle's Allegro Energy and agrees to long duration storage](#), 28 June 2023

<sup>65</sup> Renew Economy, [RWE says Australian eight hour battery win puts it on path to 3GW of storage](#), 1 May 2023

<sup>66</sup> Renew Economy, [BlackRock makes \\$700 million investment in Australian battery storage](#), 31 May 2023

<sup>67</sup> Equis, [Calala, New South Wales, About the project](#)

Octopus Investment is developing the [Blind Creek Solar Farm and BESS](#) proposal near Bungendore, NSW, with a capacity of up to 350MWac (megawatt, alternating current) of solar and 300MW/600MWh of storage.

**AGL Energy Liddell 500MW / 2,000MWh BESS**

AGL is planning a 500MW BESS at its now closed Liddell coal-fired power plant site.

## Section 7: Other Forms of Grid Firming

*While existing gas peakers provide a reliable source of seasonal firming and diversification to the BESS, the fact that investors are unwilling to invest in new gas peakers absent government subsidies speaks loudly. PHS will play a key role in seasonal storage, but patient government capital is needed given the exceptionally long construction times and likely low utilisation rates. While still emerging, CEF expects batteries on wheels (EVs) and peak shaving from industry and consumers to both play a significantly increased role in the smart grid of the future.*

### 7.1 Gas Peakers

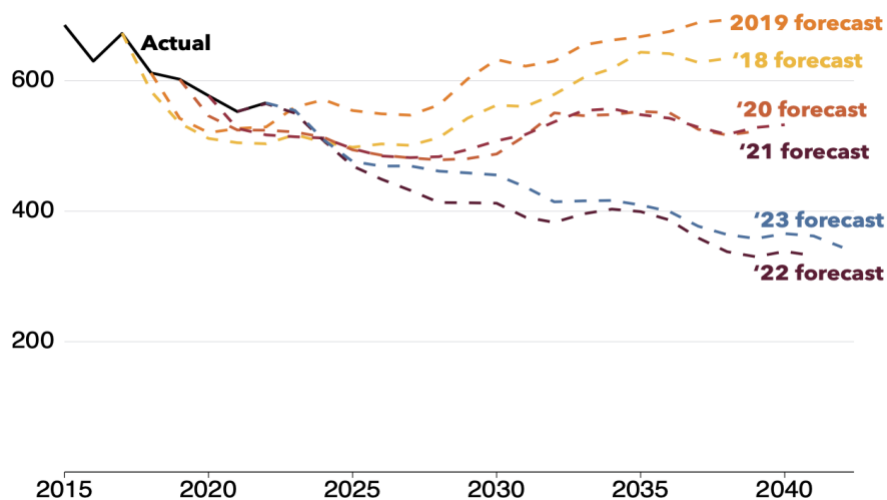
*NSW has two new gas peakers under construction, Snowy Hydro's 660MW Kurri Kurri plant, and EnergyAustralia's 316MW Tallawarra B plant, both due online around the time of the closure of Eraring coal-fired power plant in 2025. Despite the gas lobbyist spin, more gas is not the solution.*

The old fossil fuel sector lobbyist spin that gas is a transition fuel is clearly inconsistent with the facts, as outlined by the June 2023 report by the Grattan Institute.

Stripping out the methane gas industry's self-use of gas to liquify their LNG exports at Gladstone, Figure 9.1 clearly shows gas use in the domestic economy of East Australia is forecast to halve well before 2040 relative to its 2015 peak. The electrification of the six Gladstone LNG trains would increase domestic gas supply in Eastern Australia by 50%, and permanently lower electricity prices and cost of living pressures, but, we note that, at the expense of the Australian economy, the gas cartel gouging Australians has refused to discuss this option, given it would erode their profit margins and returns on investment.

**Figure 7.1: Domestic Australian Gas Use Continues To Decline, at Speed**

Domestic gas consumption (PJ)



Notes: Excludes gas consumed by the LNG industry. Each line represents the most likely scenario in consecutive Gas Statement of Opportunities reports: 2018 Neutral scenario, 2019, 2020, and 2021 Central scenarios, 2022 Step-change scenario, 2023 Orchestrated step-change (1.8 degrees C) scenario.

Source: AEMO (2018-2023), Grattan Institute, June 2023 <sup>68</sup>

<sup>68</sup> Grattan Institute, [Getting off gas: why, how, and who should pay?](#), June 2023

## **Snowy Hydro's Kurri Kurri**

November 2022 saw the Federal Government's Snowy Hydro Chair David Knox admit to Senate Estimates that the \$1bn 660MW [Kurri Kurri](#) plant, with two open-cycle gas turbines, would come online in December 2024, a year after its targeted December 2023 date due to flooding at the site, and it would initially run 100% on methane gas.<sup>69 70</sup>

While the board has claimed a 2020 capital cost of \$600m, this ignores the need for an enabling \$250m gas pipeline and the extra cost of moving to 15% green hydrogen blending at a later date, as well as the >20% capital cost blowouts that are evident across the board in 2023. This plant is being built on the site of the former Kurri Kurri aluminium smelter in the Hunter region of NSW. The plant could well run only 2-3% of the time,<sup>71</sup> but subject to resolution of the gas supply problems with this location, it could potentially intermittently run at a higher 5-10% pa utilisation rate to ease grid reliability pressures around the closures of Eraring in 2025 and Vales Point and 2028/29.

APA is building the [Kurri Kurri Lateral Pipeline](#), a 24km buried gas transmission and storage pipeline that will connect the proposed Hunter Power Project at Kurri Kurri to the existing Sydney to Newcastle pipeline, near Newcastle. Construction started 1HCY2023.

## **EnergyAustralia Tallawarra B**

EnergyAustralia has confirmed its \$300m 316MW [Tallawarra B gas peaker power plant](#) under construction in NSW's Shoalhaven region will be online by end 2023 despite the disruption to work due to the collapse of contractor Clough. EnergyAustralia secured \$80m of federal and state government funding to support Tallawarra B.<sup>72</sup> EnergyAustralia's existing 435MW combined cycle Tallawarra power station has been in operation since early 2009.

EnergyAustralia acquired the 116-hectare [Marulan site](#), about two hours south-west of Sydney, in 2010. State Planning Approval is presently in place for a gas-fired generator which remains valid until late 2024.

## **Squadron Energy's Port Kembla Energy Terminal**

[Port Kembla Energy Terminal](#) is located in Port Kembla's Inner Harbour. If completed in 2025/26, the 130PJ LNG import terminal will have the capacity to supply more than 70% of NSW's gas needs. Whether this facility gets built is an open question, given the extreme LNG price volatility and declining NSW demand profile, and increased scaling up of cleantech investments to underpin the decarbonisation objectives of Squadron Energy.

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<sup>69</sup> AFR, [No green hydrogen for Kurri Kurri on start-up: Snowy](#), 7 November 2022

<sup>70</sup> AFR, [New Snowy CEO can't rule out further delays at projects](#), 13 February 2023

<sup>71</sup> Climate Council, [Why a new gas-fired power station at Kurri Kurri makes zero sense](#), 20 May 2021

<sup>72</sup> AFR, [EnergyAustralia gas plant on track despite Clough collapse](#), 20 February 2023



## 7.2 Pumped Hydro Storage

*The Snowy 2.0 debacle of capex cost and timetable blowouts highlights that while pumped hydro storage (PHS) might play a key role in seasonal grid firming, that role is cost and time prohibitive and therefore likely to be way smaller than anticipated even two years ago.*

### **Snowy Hydro's Snowy 2.0 – 2,000MW / 58,000MWh PHS**

Snowy Hydro's Snowy 2.0 2GW 29-hour capacity project has run into severe problems, with the budget blowing out from \$2bn to the current \$5.9bn (excluding interest costs and transmission). Including the enabling grid transmission, the total capital cost will clearly exceed \$10bn.

May 2023 saw Minister Bowen confirm a likely two-year completion delay to the end of 2029, reflective of the continued board and management failures to deliver.<sup>73</sup> The full operation of all units will occur at the earliest in December 2028 but more likely December 2029.

The delay to start-up does not impact the reliability of the grid in the summer of 2025-26 after Eraring is due to close, because the project was never due to come online by then, but will be key for the slated closure of Vales Point in 2028/29.

As of June 2023 a full cost-benefit review of this failed project is being undertaken by the board, something that should have been done credibly prior to the decision to start.<sup>74</sup>

### **Origin Energy's 235MW Shoalhaven PHS expansion**

The Shoalhaven 235MW PHS expansion project remains an advanced development option but Origin currently has the proposal on hold, saying it will re-test pricing at a future opportunity when economic and market factors may have changed.

### **Energy Australia's 335MW Lake Lyell PHS**

EnergyAustralia is investigating the feasibility of a 335MW 8-hour storage [Lake Lyell pumped hydro energy storage](#) project on land it owns near Lithgow using an existing dam built for the coal power plant.

### **Other NSW PHS options**

The NSW government has provided evaluation funding for several other early stage PHS options, including the 600MW Oven Mountain PHS, 325MW Central West PHS, the 250MW Muswellbrook PHS and the 810MW Phoenix PHS.

### **WalchaEnergy – 300MW / 8-12 hours Dungowan PHS**

The WalchaEnergy project has the [300MW / 8-12 hour PHS Dungowan Dam](#) proposal 45km southwest of Tamworth, NSW, at a projected capex of \$800-1,000m.

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<sup>73</sup> AFR, [Power worries grow as Snowy 2.0 finish date blows out](#), 3 May 2023

<sup>74</sup> The Guardian, [\\$5.9bn and rising: Snowy 2.0 wrestles with delays and budget blowouts](#), 18 June 2023

## Section 8: Grid Transmission

*Grid transmission is a key enabling infrastructure investment, and needs to be expedited, consistent with the \$16.5bn June 2023 Transgrid Roadmap Transgrid.*

*Concurrent with this, Transgrid and NSW's three distribution grid operators need to re-evaluate their grid constraint assumptions and provide as much new capacity as is possible within the existing grid. After a decade of gold-plating, there has to be significant spare capacity underutilised. When Queensland's grid operator PowerLink did this assessment, it found 10GW of VRE capacity could be immediately accommodated, with serious upside for Queensland consumers and for expediting Queensland decarbonisation and capacity replacement objectives.*

*NSW needs to get moving, even as it prioritises the long term grid infrastructure investments needed to enable the REZ and Snowy 2.0.*

Paul Simshauser, CEO of Powerlink, the state owned operator of the main transmission backbone of the Queensland state grid, has re-evaluated historic engineering grid norms and assumptions and by better utilising the existing assets, says there is currently capacity for than 10GW of new renewable energy generation additions without the need for significant new investment.<sup>75</sup> Simshauser notes:

*"It's a different way of thinking about the grid, you now need the grid to be able to move solar and wind through time and space, rather than just focusing on how we meet peak demand. With a transmission network, we're going to think about all the resources on the system and how, collectively, like a symphony orchestra, they're going to hit those high notes of optimisation that means they need to work harder during the day to meet nighttime peaks."*

Simshauser says the state has been inundated with connection inquiries since the government announced it will up its renewables target to 70% by 2032, and 80% by 2035, showing there is no shortage of project proposals nor capital keen to be deployed in zero emissions infrastructure.

February 2023 saw digital modelling by Australian AI-leader [Neara](#) reveal that parts of Essential Energy's distribution network can transport twice as much electricity as Essential Energy had previously indicated, showing engineering safety limits were way too conservative, forcing goldplating of the grid and unnecessarily delay the electricity grid decarbonisation strategy.<sup>76</sup>

This should be a critical requirement before Transgrid's new gold plating impost on NSW consumers of \$16.5bn is approved by Minister Penny Sharpe.

CEF also notes that the speed of deployment of distributed solar and utility scale batteries does put a clear risk on long life, slow to build transmission grid infrastructure, as VPPs and self-use by pro-consumers (producer-consumers) means lower than forecast grid load growth, even with the electrification of everything.<sup>77</sup> Batteries will also be increasingly used for peak-shaving, reducing the role of gas peakers and offsetting the duck curve.

Our view is that the imperative to electrify everything and substitute renewables for volatile, high emissions and inflationary methane gas and imported oil use will mean that the grid upgrades

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<sup>75</sup> Renew Economy, [Queensland gets ready for a grid without coal](#), 23 March 2023

<sup>76</sup> AFR, [How AI unlocked capacity across NSW's energy grid](#), 22 February 2023

<sup>77</sup> PV Magazine, [‘Renewables will eat itself,’ says Australian analyst](#), 28 June 2023

proposed by Transgrid are a necessary enabling investment, particularly in light of the lost decade under the previous Federal government.

## 8.1 Grid Congestion

*The system wide costs of grid congestion are overstated, net of the benefit of lower wholesale electricity prices, and co-locating solar and batteries will allow a time shift to much higher evening peak supply. We see the opportunity to flood the market with cheap solar, and let the battery arbitrage solve this 'problem'.*

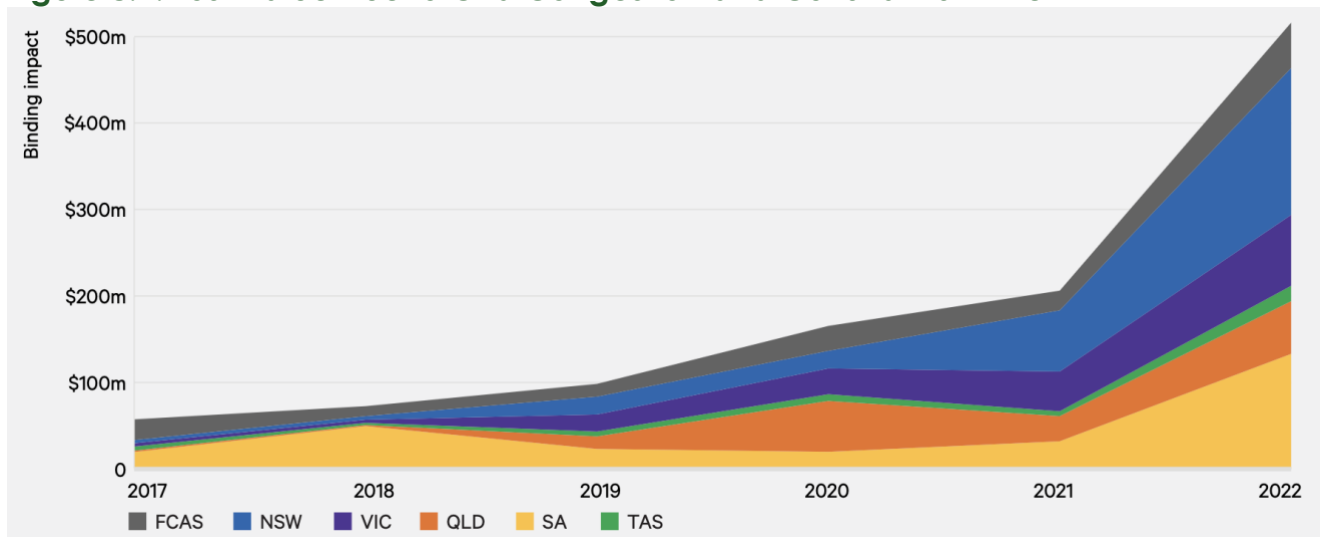
AEMO reports the cost of grid congestion to NSW generators in FY2022 was a record high \$160m with variable renewable energy generation accounting for 21.4% of NSW's total, up from FY2020 at just \$20m, when variable renewable energy generation accounted for 13.2%. To put this in cost per megawatt hour of VRE, that is A\$2/MWh in FY2020, rising to A\$10/MWh of VRE in FY2022.

OpenNEM reports the average value received in FY2022 for rooftop solar at A\$83/MWh, utility solar at A\$93/MWh and wind at A\$132/MWh, relative to the average wholesale price of \$144/MWh. So even if renewable energy generators were fully compensated for this \$10/MWh of curtailment, which they aren't, the consumer is better off for all three forms of VRE pushing down wholesale electricity prices in NSW. The benefit is much bigger in FY2020.

Climate Energy Finance's point is that some system curtailment of VRE is inevitable as we ramp up at an unprecedented pace towards 82% RE by 2030 in the NEM, and ~58% for NSW. But rather than seeing curtailment as a cost that should be minimised by restricting access of new VRE to the grid, the consumer is actually receiving a net benefit by lower overall wholesale generation costs.

Further, investors being rational will simply follow the investment pattern evident in the US, where almost all utility solar farms are co-located with batteries, so as to time-shift from selling generation at low values in the middle of the day to delivering on-demand peaking power each evening.

**Figure 8.1: Lost Value Due to Grid Congestion and Constraints in the NEM**



Source: Transgrid Roadmap, June 2023, citing AEMO ISP modelling

## Section 9: NSW's Energy and Climate Goals

*March 2023 saw a new ALP government elected to lead NSW. The new Climate, Environment and Energy Minister, Penny Sharpe, has committed to continue on with the ambitious electricity sector transformation commenced by the previous government.*

*With Liddell coal power plant closed in April 2023, and another three coal-fired power generators scheduled to shut down in NSW in the next 10 years, including Eraring in 2025, Vales Point in 2028/29, followed by Bayswater in 2032, it is critical that the state government streamline renewable energy and infrastructure approvals processes, and address engineering and social licence challenges.*

### 9.1 Emissions targets and Net Zero Commission

Labor has promised to legislate NSW's carbon emissions reductions targets, aiming for net zero by 2050 and a 50% reduction on 2005 carbon emissions levels by 2030. This is consistent with the private members bill introduced by Labor in 2022 that did not pass.<sup>78</sup>

The new government has also promised to establish a Net Zero Commission, responsible for creating and implementing a net zero plan and updating it every 5 years. The Commission will be able to make recommendations to government about how best to progress this plan.

We note that while targeting NZE by 2050 is a necessary start, the climate science and 'Common but Differentiated Responsibilities' of the Paris Agreement says that NSW, like Australia, needs to deliver NZE by 2038 to align with our global responsibilities, including our massive historic emissions legacy.<sup>79</sup> To stay on track to keep global heating of 1.5°C within reach, Australia's 2035 target would need to see a cut of 90% on 2005 levels by 2035, according to a new analysis by Climate Resource.<sup>80</sup>

#### EnergyCo of NSW

Energy Corporation of NSW (EnergyCo) is a statutory authority established under the Energy and Utilities Administration Act 1987 and is responsible for leading the delivery of Renewable Energy Zones (REZs) and rolling out the NSW Electricity Infrastructure Roadmap projects.

#### Privatisations and energy security

February 2022 saw the surprise announcement by Origin Energy of the closure of the Eraring coal fired power plant in 2025, seven years ahead of the previously slated closure date. The NSW government's focus on replacing this key generation asset with NSW-sited zero emissions alternatives, along with all the investment and employment opportunities this would bring, and the imperative to ensure energy affordability and reliability, are all abundantly clear.<sup>81</sup>

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<sup>78</sup> Herbert Smith Freehills, [What does a Minns government mean for energy projects and the environment in NSW?](#) 29 March 2023

<sup>79</sup> The Guardian, [Australia needs to reduce emissions to net zero by 2038 to do 'fair share' to contain global heating, analysis shows](#), 19 June 2023

<sup>80</sup> Climate Resource, [Updated assessment of Australia's emission reduction targets and 1.5°C pathways](#), June 2023

<sup>81</sup> NSW Government, [NSW response to closure of Eraring Power Station](#), 19 February 2022

During the election campaign, then Opposition Leader now Premier Chris Minns said that he would consider buying back Eraring if Labor won the election, to ease security of supply concerns and power prices.

The incoming government has also promised to end privatisation of government assets and service providers. In the energy space, this includes Endeavor Energy, Ausgrid and Essential Energy.

### **NSW Energy Security Corporation**

The government has committed to creating the NSW Energy Security Corporation, a State-owned corporation with \$1bn of funding and a mandate to accelerate investment in renewable energy assets. The new Corporation will provide finance and in some cases co-invest in partnership with private firms to work on storage solutions like PHS and community batteries to provide dispatchable grid stability. The new Corporation will operate similarly to the federal government's CEFC.<sup>82</sup>

The new Corporation will receive an initial \$1 billion in funding, drawn from the existing Restart NSW Fund (a fund established in 2011 to enable the funding of high-priority infrastructure projects). Labor's pre-election campaign describes its plan for the new Corporation as capable of producing an additional 12GW of renewable energy and 2GW of long duration storage by 2030.

### **Streamlined approvals for renewables?**

To be successful, the incoming government's commitment to climate change will require streamlining and acceleration of the approvals process for renewables projects. Federal Minister for Energy Chris Bowen has made similar promises. We are yet to see at a Federal or State level what a streamlined approvals process might look like and how it might be achieved.

At a State-level, under the previous Labor government, major renewables projects were declared to be critical infrastructure and assessed under Part 3A of the Environmental Planning and Assessment Act 1979 (NSW). That regime ended and private major projects are now largely assessed under the State Significant Development (SSD) regime. The current process can present a hurdle to investment in renewables because of the length of time it takes to obtain development consent and the risk that consent will not be achieved at all.

There are various options open to the Planning Minister, Paul Scully, to streamline renewables approvals and increase certainty without major legislative reform. These could include declaring private major renewables projects to be critical state significant infrastructure or requiring the Independent Planning Commission to hold public hearings in relation to SSD applications for renewables. The latter would turn-off merits appeal rights (in the same manner that they are turned off for mining projects with public hearings).

## **9.2 NSW to cut carbon emissions by 70% by 2035**

The NSW Government has a Net Zero Plan target to halve emissions by 2030, reduce by 70% by 2035 (compared to 2005) and achieve net zero by 2050.<sup>83</sup> We assume this still stands under the Minns government.

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<sup>82</sup> The Guardian, [NSW Labor pledges \\$1bn state-owned investment firm for renewable projects if elected](#), 19 February 2023

<sup>83</sup> NSW Government, [NSW Climate and Energy Action](#)

## 9.3 NSW Climate and Energy Action

The NSW Climate and Energy Action Plan<sup>84</sup> is centred around the benefits of the sustained shift to renewable energy, firmed by demand response management tools, PHS (including the Federal Government's Snowy Hydro's Snowy 2.0), EV-to-grid charging and utility scale batteries.

The energy sector is undergoing a major transformation. Renewable energy in our electricity supply mix is continuing to grow and plays a critical role in reducing emissions. NSW now has 16,100MW of renewable energy generation capacity (including 4.8GW of hydro), which is 60% of total installed capacity in our state. The NSW Government's Electricity Infrastructure Roadmap<sup>85</sup> makes REZs central to the plan to transform the NSW electricity system into one that is cheap, clean and reliable.

### ACT Government Leadership

We also note NSW is well behind its leading peers, namely Tasmania, South Australia and the ACT. The ACT has delivered 100% renewable electricity since 2020, and in April 2023 undertook additional steps including announcing the 250MW / 500MWh Big Canberra Battery and a gas phaseout plan in support of the ACT Government's commitment to achieve net zero emissions in the Territory by 2045.

Electricity consumers in the ACT are experiencing price rises lower than the rate of inflation in the coming year, thanks to the benefits of low cost wind and solar contracted by the government under its 100% renewables policy. While consumers in most states are being hit by electricity price rises of 20-27% in 2023/24, consumers in the ACT have seen an average rise of just 4.2%, lower than the rate of inflation. The local regulator says that the nature of the wind and solar contracts, which means the profits from higher wholesale prices are fed back to consumers, rather than the wind and solar project owners, is saving households an average of \$225 a year. "Without the ACT's large scale renewable energy contracts, the average household on the regulated standing offer would have faced electricity bills around \$225 higher," the government said.<sup>86</sup>

## 9.4 NSW Renewable Energy Zones

*The NSW Government policy prioritises REZs, accelerated decarbonisation, and facilitating the building of low cost, zero emissions, domestic replacement generation capacity to replace the end of life coal fired power plants NSW has historically relied upon.*

June 2022 saw the NSW 2022/23 budget allocate \$1.2bn to the Transmission Acceleration Facility to fast-track REZs and fund the development stages of transmission and other infrastructure, which would then be repaid by the private generator that agreed to build the project.<sup>87</sup>

The Facility will be administered by EnergyCo to deliver NSW' Electricity Infrastructure Roadmap.

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<sup>84</sup> NSW Government, [NSW Climate and Energy Plan: The Shift to Renewables](#), accessed 22 January 2023

<sup>85</sup> NSW Government, [Electricity Infrastructure Roadmap](#), accessed 22 January 2023

<sup>86</sup> Renew Economy, [Low cost wind and solar protect ACT consumers from bill shock once again](#), 8 June 2023

<sup>87</sup> NSW Government, [\\$1.2 billion to fast track renewable energy zones](#), 10 June 2022



Australia's first REZs will be established in NSW, in the Central West Orana<sup>88</sup> and New England regions by 2030, with three others to follow in the south-west, Hunter-Central Coast and Illawarra regions, unlocking a wall of global capital keen to deliver on this investment opportunity.<sup>89</sup>

### REZ Delays

May 2023 saw the Minister Penny Sharpe commit to continue with the previous NSW Government electricity plan. However, she noted the transmission infrastructure required to connect the zones will cost more than \$10.6bn, which will be borne by the private sector and renewable energy providers that bid to build the generating capacity. REZs are facing delays in coming onstream and capex cost blowouts, with Minister Sharpe stating the cost of transmission infrastructure and preliminary works to connect the Central West Orana zone to the broader network, originally about \$400-800m, was now expected to be \$3.2bn.<sup>90</sup>

The Central West Orana REZ's "energisation date" was also recently pushed back from 2025 to 2027-28 due to an increase in proposed project size from 3GW to 4.5GW. Similarly, the New England REZ will now start in 2029 compared with an initial 2027 goal. The Hunter-Central Coast zone will follow. The delays reflect the route changes and lack of progress in building out the enabling infrastructure (roading, worker accommodation, water, sewerage et al).<sup>91</sup>

EnergyCo gave the following June 2023 update:

*"The procurement of a Network Operator for the Central-West Orana REZ is at an advanced stage with EnergyCo recently selecting ACE Energy as the first ranked proponent. EnergyCo is preparing the Environmental Impact Statement for Stage 1 of the REZ transmission project. The EIS project will be displayed for public exhibition in 3QCY023 and will include community consultation and a formal submissions process."*

The enabling grid transmission is a key challenge both in terms of engineering and social licence to operate. To deliver on the REZ and the 82% RE by 2030 target, these challenges must be addressed as a priority.

June 2023 saw media reporting that high voltage transmission lines needed for the Hunter-Central Coast Renewable Energy Zone are in potentially catastrophic land-use conflict with the Hunter Gas Pipeline route.<sup>92</sup> This clearly begs the question why the government should distract effort, money and social licence trying to build new fifty-year-lifespan methane gas pipelines given that the push to electrify everything means domestic gas demand is set to halve by 2040 – refer Section 7.1.

With Liddell coal power plant closed in April 2023, another three coal-fired power generators are scheduled to shut down in NSW in the next 10 years, including Eraring, seven years ahead of schedule in 2025, Vales Point in 2028/29, followed by Bayswater in 2032. Being exposed to export comparative coal supply means NSW coal power plants are increasingly unreliable, high emissions and very expensive options requiring ongoing taxpayer subsidies to continue operations.

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<sup>88</sup> Renew Economy, [NSW formally declares Australia's first Renewable Energy Zone](#), 11 November 2021

<sup>89</sup> Renew Economy, [NSW flooded with \\$100bn in renewable and storage projects for Hunter REZ](#), 16 February 2022

<sup>90</sup> Australian Financial Review, [More than \\$10b needed for poles and wires in NSW renewables plan](#), 25 May 2023

<sup>91</sup> Newcastle Herald, [Mid-Western Council mayor Brad Cam says Renewable Energy Zone roll out is going nowhere fast](#), 13 June 2023

<sup>92</sup> Newcastle Herald, [Hunter Gas Pipeline and REZ transmission line routes collide at Muscle Creek](#), 19 June 2023



Minister Sharpe forecasts that by 2032, NSW would have access to ~50GW of capacity including additional capacities of 11GW of wind, 6GW of large-scale solar, 5GW of rooftop solar and 6.5GW of long-duration, large and small-scale storage and 0.5GW of new gas firming capacity.

## **9.5 A \$7.8bn Joint Federal-NSW Government investment in NSW grid transmission capacity upgrades**

December 2022 saw the Albanese government commit \$4.7 billion of new investment for NSW renewable energy infrastructure development, working alongside the \$3.1 billion investment allocations by the NSW Government in grid upgrades.<sup>93</sup> A core objective is to facilitate investment in the enabling infrastructure to rollout REZs at speed and scale to help permanently reduce rampant fossil fuel hyperinflation of Australians' energy bills in 2022, and again in 2023.

The Commonwealth money will go towards building, modernising and reconfiguring transmission lines from the state's REZs to the grid. This investment will also connect Snowy 2.0 to the grid.

Prime Minister Anthony Albanese has linked the strengthening and reconfiguring of the grid with energy security and lower prices, stating that: "...The Commonwealth has worked hand in glove with the states and territories to shield Australian households and businesses from the worst impacts of the energy crisis caused by Russia's illegal invasion of Ukraine...The Australian economy can seize the opportunity of more affordable and reliable renewable energy over the long term – creating jobs in the regions that have always powered Australia, and insulating ourselves from global fossil fuel shocks at the same time. Support for critical transmission infrastructure like Sydney Ring, VNI West and HumeLink, to get across the line, will help transform Australia into a renewable energy superpower."<sup>94</sup>

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<sup>93</sup> ABC, [Albanese government commits \\$4.7 billion for NSW renewable energy investment](#), 21 December 2022

<sup>94</sup> Prime Minister of Australia press release, [Landmark Rewiring the Nation deal to fast-track clean energy jobs and security in NSW](#), 21 December 2022

## Section 10: Federal Momentum

*Federally, Australia finally has a commitment to act on the climate science, and positive momentum, with the first 14 months of the new Albanese Labor government seeing: an 82% Renewables by 2030 target; legislation of the Climate Act 2022 and the Safeguard Mechanism; \$20bn for Rewiring the Nation; the proposed Capacity Investment Scheme; a \$1.3bn 'down payment' in the 2023 budget for Electrification of Everything; and the establishment of the NetZero Authority.*

August 2022 saw the Federal Government pass the Climate Change Act 2022,<sup>95</sup> a landmark bill that legislates the nation's commitment to reduce greenhouse gas emissions 43% below 2005 levels by 2030, and achieve net zero by 2050.

It sets out Australia's greenhouse gas emissions reduction targets, requiring annual climate change statements, conferring advisory functions on the Climate Change Authority, and requiring ten key Statutory Authorities including AEMO, Export Finance Australia (EFA), the Northern Australia Infrastructure Facility (NAIF), the CEFC, ARENA and the CSIRO et al to formally take the climate science into central consideration in all decisions. The Act also updates the Climate Change Authority legislation to reference the purposes of the Paris Agreement in the principles it considers when providing advice.

Minister for Climate Change and Energy Chris Bowen said: "Current issues confronting Australian and global energy markets highlight why this long-term commitment is so important. This Bill confirms our commitment to ambitious but realistic targets supported by Australia's states and territories, business, industry, unions, environmental and community groups. It provides a platform for collaboration to drive down emissions while ensuring reliable energy supplies. The Bill makes it clear that 43% is our minimum commitment and does not prevent our collective efforts delivering even stronger reductions over the coming decade."<sup>96</sup>

This received glowing endorsements globally for the significant 'landmark' move forward towards alignment with the climate science and Paris Agreement.<sup>97</sup> The Financial Times reported that: "Australia passed a landmark climate bill on Thursday, bringing the resource-rich country back in line with the global push to cut carbon emissions after years of pushing back against such efforts. Australia is one of the world's largest miners and one of the biggest coal exporters. The country had been a climate policy laggard for years with former prime minister Scott Morrison once brandishing a lump of coal in parliament as a testament to his Liberal party's steadfast support for the industry."

### 10.1 82% Renewables Electricity by 2030

Tasmania's 200% renewables by 2040 target and South Australia's 100% by 2030 target are world leading, but these two states represent just 5% and 6% of total Australian electricity demand in 2022 respectively.

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<sup>95</sup> Australian Government Federal Register of Legislation, [Climate Change Act 2022](#), 14 September 2022

<sup>96</sup> Australian Government, [Climate Change Bill 2022](#), 28 July 2022

<sup>97</sup> Financial Times, [Australia passes landmark legislation to cut carbon emissions](#), 8 September 2022

The Federal Government's 82% renewables by 2030 is highly ambitious, aligning with the climate science and reinforcing the 50% by 2030 Queensland government (70% by 2032, 80% by 2035) and 65% by 2030 Victorian Government (95% by 2035).

We note NSW is yet to detail a 2030 or 2035 RE target, notwithstanding that it does have 50% by 2030 and 70% by 2035 emissions reduction targets set by the previous government in its Net Zero Plan.

As Minister Bowen says, it would have been far better to have started this journey a decade back, but there is still 7 years till 2030 and a wall of new project proposals to deliver on this ambition:<sup>98</sup> "We've got the capital, we've got the policy, we've got the technology, we've got the pipeline, I want to see more of that pipeline moving to final investment decision ... and environment approvals rolling out. It's fashion (for some) to say 82% and 43% is too ambitious. I reject both of those. It's ambitious, but achievable."

Given that NSW is 32% of total Australian on-grid electricity demand, and Queensland and Victoria are below the Federal target, other states need to accelerate their RE ambition timelines, and NSW would need to deliver a >82% renewables by 2030 to give the Federal target any scope for delivery.

As noted above, CEF models that the closure of Liddell in 2023, Eraring in 2025 and Vales Point in 2029 would put NSW on track for 68% renewables (assuming half our state electricity imports are renewables). Coal would decline to ~23.5% and gas to 3.5% share in 2030.

All of this suggests Australia needs to collectively move a lot faster, and bring forward end of life coal power plant closures, not delay the announcements already made.

A similar message has been sent by AEMO CEO Daniel Westerman and ENGIE Australia CEO Rik De Buyserie.<sup>99</sup> Neither are saying slow down, quite the opposite – both are saying we need to collectively move faster.

## 10.2 \$20bn Rewiring the Nation Fund

June 2023 saw the CEFC expand its capital base threefold with a \$20.5bn capital injection. The vast bulk of the new funding – \$19bn – will help underwrite transformation of Australia's energy grid infrastructure, including through huge and costly new electricity transmissions projects, long duration energy storage and distribution network infrastructure.<sup>100</sup>

The enormity of Australia's task is laid out in AEMO's ISP, which forecasts the need for 10,000km of new transmission lines and nine times the large-scale renewable generation. Energy storage capacity is expected to need to increase by a factor of 30 by 2050 – and over 7 times from 2GW today to 15GW by 2030.

## 10.3 Capacity Investment Scheme

December 2022 saw the Federal Energy Minister Chris Bowen, alongside the state energy ministers, commit to the Capacity Investment Scheme (CIS) to provide the national framework to drive new

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<sup>98</sup> Renew Economy, [Bowen: We're playing catch-up, but 82 pct renewables target can be met](#), 11 July 2023

<sup>99</sup> AFR, [Engie's new local boss says Australia will fail its 2030 climate goals](#), 22 June 2023

<sup>100</sup> Renew Economy, ["We must move quickly:" CEFC gets \\$20bn to put renewable transition back on track](#), 22 June 2023

renewable dispatchable capacity. This new revenue underwriting mechanism aims to ensure reliability in the rapidly changing energy market into the future and to unlock \$10bn of investment in clean dispatchable power. CIS aims to complement rather than overlap with existing state/territory schemes. The Australian Government committed to release further details on the scheme in 2023 with a view to the first auction also occurring in 2023.<sup>101</sup>

The May 2023 Federal Budget allocated undisclosed (commercial in confidence) funding to support the CIS, including \$10m to AEMO over five years to deliver the auctions, whilst the Department of Climate Change and Energy has been awarded \$6.4m to design the auction process.

May 2023 saw South Australia and Victoria nominated as the first two states to hold auctions for storage under the Capacity Investment Scheme,<sup>102</sup> with new tenders due in October 2023.

June 2023 saw a joint Federal-NSW Government announcement to treble the delivery of 930MW of 2-hour dispatchable capacity in the NSW Energy Roadmap's firming tender, with the Commonwealth funding to underwrite investment for up to an additional 550MW of firmed capacity on top of the existing 380MW NSW had already announced. 3.3GW of project proposals have already been submitted to this tender process to AEMO Services.<sup>103</sup> This announcement accelerates investment in firming, unlocking faster investment in new variable renewable energy capacity across NSW, and eliminates the shortfall in capacity by FY2029 AEMO had forecast.<sup>104</sup> A key positive step forward, particularly in light of the ongoing delays at Snowy 2.0 and Kurri Kurri.

CEF concurs with Minister Sharpe referencing the large number of investors wanting to invest in NSW's energy system, and her signalling that "any risks around grid reliability can be resolved by accelerating the development of a clean, reliable, consumer-focused energy system".<sup>105</sup>

## 10.4 A \$1.3bn 'down payment' in the 2023 budget for Electrification of Everything

Federal Treasurer Jim Chalmers' 2023/24 budget provided a \$1.3 billion Energy Savings Package to deliver upgrades for homes and businesses. The \$1.3bn Household Energy Upgrades Fund will create low-interest loans and fund upgrades to social housing to improve energy performance. The Fund will inject \$1 billion into the CEFC to unlock 110,000 low-interest loans for energy-saving home upgrades, in partnership with private lenders.

The Fund will also provide \$300m to partner with states and territories to make energy performance upgrades to 60,000 social housing properties, cutting energy use by one-third and delivering savings on tenants' energy bills.<sup>106</sup>

The Government will improve NaTHERS and expand it to existing homes to provide a CSIRO designed star rating of energy performance — helping Australians make the best choices when it comes to renting, purchasing or renovating their homes.

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<sup>101</sup> Australian Government, DCCEEW, [CIS to power Australian energy market transformation](#), 22 December 2022

<sup>102</sup> Renew Economy, [South Australia and Victoria to host first auctions under Capacity Investment Scheme](#), 12 May 2023

<sup>103</sup> Renew Economy, [Bowen: We're playing catch-up, but 82 pct renewables target can be met](#), 11 July 2023

<sup>104</sup> Joint media release: [Capacity Investment Scheme to power NSW with clean, cheap, reliable energy](#), 29 June 2023

<sup>105</sup> AFR, [Federal scheme to unlock \\$10b investment in firming power](#), 28 June 2023

<sup>106</sup> Federal Budget 2023/24, [Delivering cost-of-living relief](#)

The Government will also modernise and expand the Greenhouse and Energy Minimum Standards program to make it easier to choose cheaper-to-run appliances and support emissions reduction.

Australia's first National Electric Vehicle Strategy will also ensure consumers have a better choice of electric vehicles and encourage greater use of cleaner, cheaper-to-run vehicles.

From 1 July 2025, the Government will extend the clean building managed investment trust withholding tax concession to eligible new data centres and warehouses. Buildings will also need to satisfy higher energy efficiency standards to qualify for the concession.<sup>107</sup>

## 10.5 National NetZero Authority

The 2023 budget saw the establishment of the NetZero Authority, with initial funding of \$87m.<sup>108</sup> The Authority will work across all levels of government and with workers, regional communities and First Nations people to facilitate economic development and diversification and help smooth the changes as Australia moves to a clean energy economy.

## 10.6 The \$1.9bn Powering the Regions Fund

As part of the Powering the Regions Fund, the \$400m Industrial Transformation Stream and \$400m Critical Inputs to Clean Energy Industries stream will support the growth of new clean energy industries in regional areas, as well as innovative efforts to decarbonise existing industrial activities. The \$600m Safeguard Transformation Stream of the Powering the Regions Fund will support trade-exposed facilities covered by the Safeguard Mechanism to reduce their on-site emissions and boost their global competitiveness by exporting embodied decarbonisation.

## 10.7 A new \$100m Community Energy Upgrades Fund

June 2023 saw the Albanese Government partner with local governments to deliver energy upgrades and bill savings for community facilities like local pools, sporting clubs and community centres via a new \$100m Community Energy Upgrades Fund. This new funding will replace energy-intensive heating in council pools with heat pumps and install energy efficient lighting and battery storage at sporting fields, libraries and community centres.<sup>109</sup>

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<sup>107</sup> Federal Budget 2023/24, [Powering Australia with cheaper, cleaner, more reliable energy](#)

<sup>108</sup> PM of Australia, [National NetZero Authority](#), 5 May 2023

<sup>109</sup> Prime Minister of Australia, [Media Release](#), 16 June 2023

## 10.8 The Investment and Policy Objectives of AEMO's Integrated System Plan

### *AEMO's ISP objective targets 82% renewables by 2030.*

In June 2023, Australian Energy Market Operator (AEMO) CEO Daniel Westerman gave an industry briefing titled “Managing the tensions in the energy transition to maximise the benefits for all Australians”.<sup>110</sup>

Westerman started by acknowledging that there has been a seismic shift in the pace of the energy transition. As discussed in Section 2 above, the Australian Government has legislated a target of net-zero emissions by 2050 and, by 2030 aims to have 82% of energy in the NEM from renewable sources. This target complements individual state and territory government energy policies and renewable energy zones and targets.

Westerman highlighted that as Australia moves rapidly away from its traditional dependency on coal generation, our energy future will be built on four pillars:

1. Low-cost renewable energy, taking advantage of the abundant wind, solar and hydro resources that Australia has to offer;
2. Firming technology like pumped hydro, batteries, and gas generation, to smooth out the peaks and fill in the gaps from that variable renewable energy;
3. New transmission and modernised distribution networks to connect these new and diverse low-cost sources of generation to our towns and cities; and
4. Power systems capable of running, at times, entirely on renewable energy.

AEMO's blueprint for the NEM is detailed in its biennial ISP. The ISP is a least-cost, least-regret pathway to what the power system should look like over the next 30 years, as the size of the NEM nearly doubles, from serving 180 TWh of electricity to 320TWh by 2050.

What was the out-of-left field scenario only 2-3 years ago is now the central scenario. AEMO's Step Change sees 40% of coal-fired generation capacity in the NEM withdrawn over the next five years, 60% by 2030 (that's 14GW), 87% by 2035, and 96% by 2040. The NEM will need nine times the utility-scale VRE capacity, from 16GW today to 141GW in 2050. Australia is currently installing VRE faster than at any time in history. AEMO concludes that this record rate needs to be maintained every year for a decade to triple VRE capacity by 2030 – then almost double it again by 2040, and again by 2050.

AEMO is confident that grid reliability, affordability and decarbonisation can all be achieved in the timeframe required, but only if key REZs, grid transmission and firming infrastructure projects can be delivered at unprecedented speed and scale, and on time, with accelerated supportive, thorough approval processes, leveraging the grid integration powers of both geographic and technology diversity – on- and off-shore wind, plus utility scale and distributed rooftop solar – across Australia.

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<sup>110</sup> AEMO, AEMO CEO speech at Australian Energy Week, 20 June 2023