CLIMATE ENERGY FINANCE

Updated: The Lights Will Stay On: NSW Electricity Plan 2024-2030

Our assessment of new electricity sector and policy developments over the last six months shows the on-schedule phased closure of the Eraring Coal Power Station is entirely doable with accelerated energy transition efforts evident of late

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Tim Buckley, director, Climate Energy Finance

Quotes from report author Tim Buckley are available at this link.

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ABOUT CEF: Established in 2022, Climate Energy Finance (CEF) is an Australian based, philanthropically funded think tank. We work pro-bono in the public interest on mobilising capital at the scale needed to accelerate decarbonisation consistent with the climate science. Our analyses focus on global financial issues related to the energy transition, and the implications for the Australian economy, with a key focus on the threats and opportunities for Australian investments and exports. Beyond Australia, CEF's geographic focus is the greater Asian region as the priority destination for Australian exports. CEF also examines convergence of technology trends in power, transport, mining and industry in accelerating decarbonisation. CEF is independent, non-partisan, and works with partners in the NGO, finance, business, research, and government sectors.

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Executive Summary

There has been significant progress in the NSW electricity market transformation over recent months, with strong collaborative efforts by the NSW and Federal Governments. This gives us even more confidence in our previous analysis of July 2023 that with continued improvements and delivery on projects under development, the lights will stay on in NSW as the hyper-expensive, high-emissions, end of life 2.88 gigawatt (GW) Eraring coal fired power plant, Australia's biggest, is progressively phased out around its August 2025 closure date. There is no case for taxpayer subsidies in the hundreds of millions to keep it open.

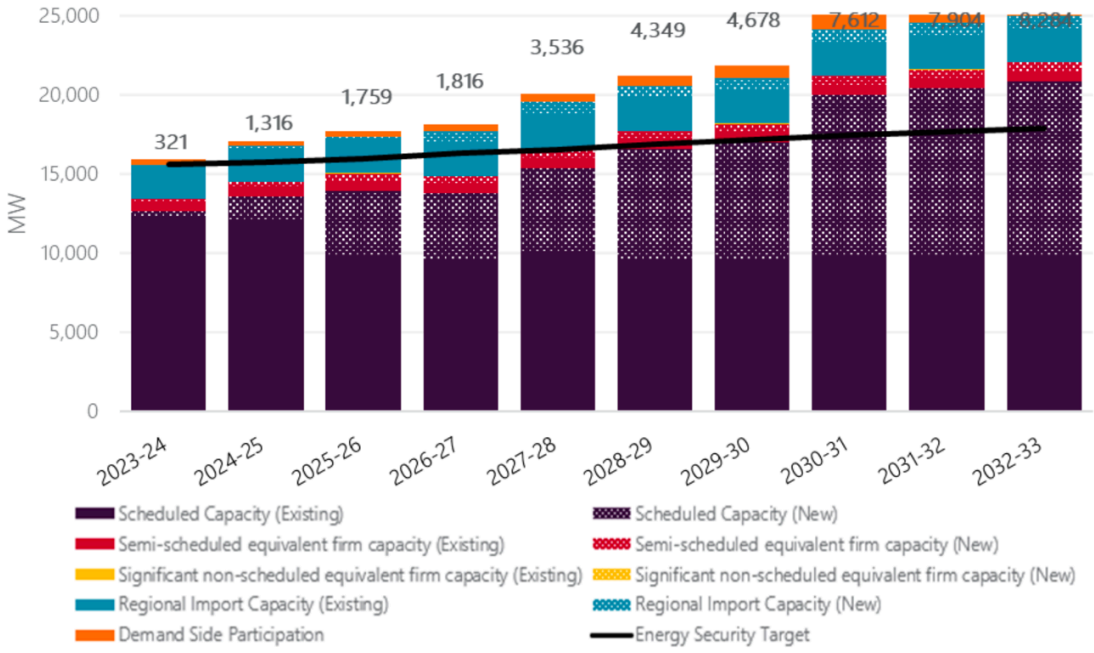
The Australian Energy Market Operator's (AEMO) October 2023 Energy Security Target Monitor Report for NSW Climate and Energy Minister Penny Sharpe (released publicly in December 2023) supports our contention, showing that once federal and state capacity schemes are included, there is no NSW reliability gap forecast in any year this coming decade out to 2033, notwithstanding the on-time closure of Eraring in 2025.[1]

We present a detailed analysis of electricity sector transformation over the last ~six months with a focus on NSW, confirming that there is no material reliability gap, consistent with both AEMO's analysis and CEF's July 2023 report, "The Lights Will Stay On 1: NSW Electricity Plan 2023-2030".[2]

Utility scale renewables and storage

NSW is on track to deliver on the commitments AEMO has assumed in its analysis – Figure 1.

Figure 1: NSW Electricity Security Target, FY2024-FY2033



Source: AEMO Energy Security Target Monitor Report, October 2023

[1] AEMO Energy Security Target Monitor Report, October 2023
[2] CEF, The Lights Will Stay On: NSW Electricity Plan 2023-2030, 18 July 2023

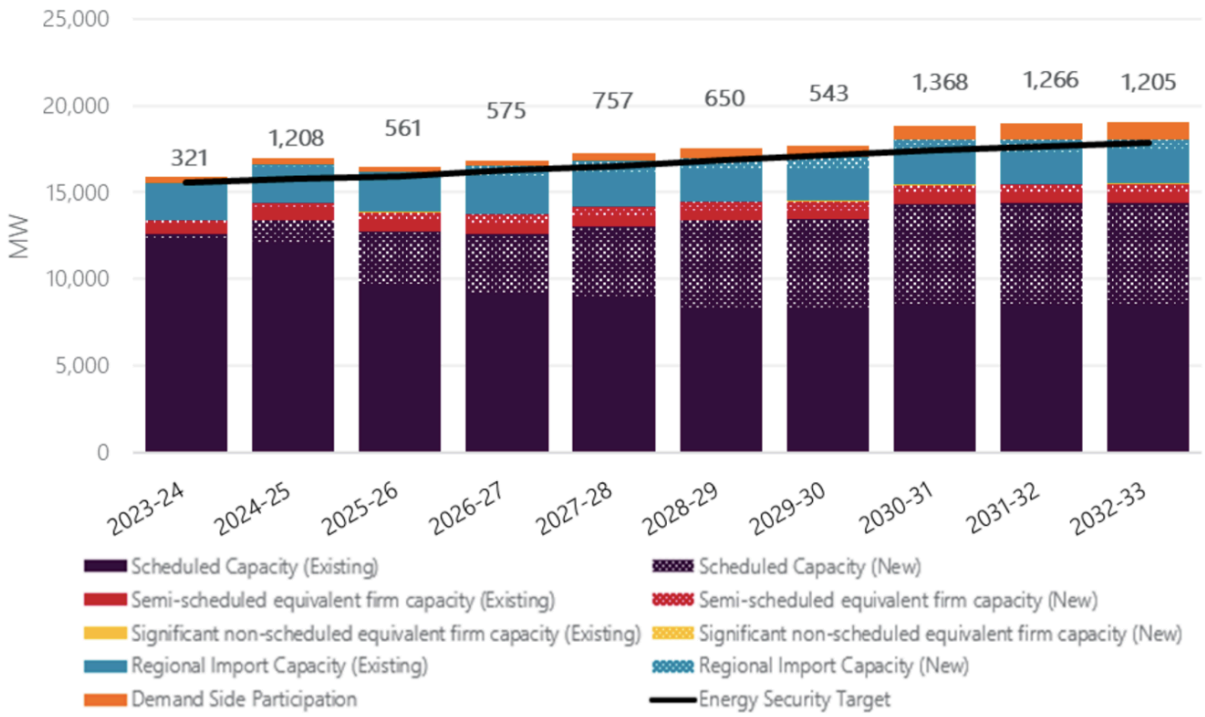
The Round 2 wind, solar and storage tender of November 2023, conducted under the NSW Electricity Infrastructure Roadmap, is set to deliver 1,070MW of battery energy storage system (BESS) firming capacity by end 2025, building on the 1,445MW of new firmed renewables capacity awarded in Round 1 tender in May 2023.

The December 2023 Round 3 tender underwrites another 1,274MW of firmed renewables capacity.

June 2024 will see Round 4 awards – for more detail, refer Section 1.2.

With these Round 2 and 3 projects alone, NSW is already set to meet its Energy Security Target needs according to AEMO's analysis, see Figure 2:

Figure 2: NSW Electricity Security Target including only Rounds 2 & 3, FY2024-FY2033



Source: AEMO Energy Security Target Monitor Report, October 2023

The deflation of costs for renewables and storage helps underpin acceleration of their deployment.

BloombergNEF estimates global battery system costs fell 80% in the last decade and another 14% in 2023, and solar module prices declined 45% year on year (yoy) in calendar year (CY) 2023. BNEF forecasts BESS prices will halve again by 2030. As such, the relative capital cost of BESS improved dramatically, as did the technology. The rise and rise of solar continues, lifting the likely arbitrage value of time-shifting solar generation into the evening peak.

NSW is leading the world in the financing, approval and construction of new BESS projects, with the 850 megawatt (MW)/1,680megawatt hour (MWh) Waratah Super Battery under construction, while AGL reached a final investment decision (FID) in December 2023 on its $750m 500MW/ 1,000MWh Liddell BESS. Origin Energy has commenced construction of phase 1 of its 700MW/2,800MWh Eraring BESS. The list of project proposals is enormous, and growing weekly – refer Section 1.3.

After a growing industry clamour for an end to very substantive and costly new project approval delays in the state, NSW finished 2023 with a range of critically important wins in terms of new renewable

infrastructure awards, approvals, FIDs and commencements of construction.

December 2023 saw approvals by the Department of Planning and Environment of ENGIE's 290MW Hill of Gold wind farm (although still subject to an Independent Planning Commission (IPC) review), and Virya Energy's Yanco Delta 1.5GW wind farm, along with a 800MW/800MWh BESS. December 2023 saw the IPC approve the Oxley 215MW solar farm and Trina Solar's 200MW Glennellen solar farm. January 2024 saw Squadron Energy commence construction of the 414MW Uungula Wind Farm after winning the December Round 3 tender – refer Section 1.3.

EnergyAustralia's 316MW Tallawarra B gas peaking power plant fired up for the first time in December 2023 and Snowy Hydro's 660MW gas Hunter Power Project is due for commissioning in December 2024. On transmission, ElectraNet has successfully completed the 900km South Australian stage 1 of the $2.3bn Project EnergyConnect, the new high-voltage line between South Australia and NSW.

There remains a very strong NSW proposed pipeline of projects of some 50GW of firmed renewables, many already in the approval process. We hope to see wholesale improvements in project approval delays with the restructure of the Department of Planning and Environment effective 1 January 2024.[3]

Consumer energy resources (CER)

Consumer energy resources (CER) uptake remains very robust, with 3.17GW of rooftop solar installed in CY2023 across Australia, the second highest on record, making this a resource that can be deployed at speed and scale as a key contributor to solving the energy transition.

We have urged the NSW Government to prioritise collaboration with the Federal Government to introduce policies to accelerate deployments, along with behind the meter storage, vehicle to grid (V2G), building and energy efficiency, as well as the rollout of smart meters and CER orchestration.

Electrification is part of the need to drive energy efficiency though our entire economy.[4] The January 2024 $206m social housing energy savings initiative for 30,000 disadvantaged households, announced jointly by the NSW and Federal Governments, is great to see. These measures are all a lot faster and lower cost to deploy than utility scale infrastructure, and complement the longer timeframe work the NSW government is doing on Renewable Energy Zones (REZs).[5]

As an example of 'electrification of everything' taking off, the market for air source heatpumps in Australia grew a staggering 71% yoy in the first nine months of calendar 2023 (9MCY2023), with NSW absolutely leading the uptake with a 58% share nationally to-date in 2023 (up from just a 13% share in the previous corresponding period) – refer Section 3.

Australia now needs electricity price tariff reform to change consumer behaviour and ensure that V2G becomes a smart grid enabler, rather than a problem. Our electricity retailers are not waiting, with both Origin Energy and AGL Energy leveraging and modernising their IT and consumer platforms to enable this, putting a major focus on grid orchestration's growing role to maximise customer service and value.

Electricity demand and supply

We have updated our NSW electricity demand and supply modelling out to 2030.

A key issue is that demand growth of +0.6% yoy in CY2023 was well below AEMO's +2.7% annual

[3] NSW Department of Planning and Environment, 1 January 2024
[4] RMI, The Eight Deadly Sins of Analyzing the Energy Transition, 13 October 2023
[5] Nexa Advisory, Putting the Power in the People's Hands, Distributed Energy Resources – a key contributor to the clean energy transition, October 2023

compound growth rate (CAGR) forecast through to 2030 and beyond.

Extrapolating AEMO's overly high demand growth assumptions out to 2030 means the grid reliability gap risks are potentially overstated. We note over the last two decades, electricity demand in NSW has been flat. This lower observed demand growth provides additional insurance, guaranteeing NSW electricity supply reliability, even if some projects are delayed during delivery.

The NSW Government's Peak Demand Reduction Scheme, which provides financial incentives to households and businesses to reduce energy consumption during hours of high peak demand, is also an important initiative that is lowering the cost in improving grid reliability.

Notably, on supply, renewables share (utility scale wind and solar, rooftop solar and hydro) was a record high 31.3% in CY2023, up from 28.9% in CY2022, having more than doubled in the last five years.

Electricity prices

Over time, wholesale prices and retail total costs are likely to fall as renewable energy share rises.

NSW saw wholesale electricity prices drop 47% yoy to average $105/MWh in CY2023, with 4QCY2023 averaging -40% yoy to $72/MWh.

After two years where the hyperinflation of fossil fuel prices has driven 20% pa retail electricity price increases, CEF expects the Default Market Offer (DMO) to drop double digits come 1 July 2024, bringing much overdue energy bill relief for NSW citizens.

The delivery of significant new low cost firmed renewables capacity will help cement this trend in the longer term, even as it concurrently helps deliver n the NSW Climate Change (Net Zero Future) Act's excellent 70% emissions reduction interim target for 2035, which passed NSW parliament with multiparty support in November 2023, a key achievement of the NSW Energy Minister and Government.

We conclude that NSW is moving to systemically address the energy, climate and cost of living crises that have smashed Australia and the world in the last two years. Renewables and firming capacity additions to offset the on-time closure of Eraring and ensure reliability of supply and reduce prices are a key part of this.

NSW' progress is in the context of Federal Climate and Energy Minister Chris Bowen's profound upgrade of the Federal Government's policy commitment to 82% renewables by 2030 with the 32GW Capacity Investment Scheme (CIS) announced in late 2023, and Australia's pledge at COP26 to treble renewables and double energy efficiency by 2030.

For all the mis- and disinformation about the purported intermittency of renewables, the rise and rise of ever-lower cost variable renewable energy firmed by battery storage is far exceeding even the most bullish forecasts, and, together with the policy progress and cooperative federalism noted above, makes the decarbonisation of the electricity grid and 'electrification of everything' a key enabler of NSW' and Australia's energy transition and Net Zero Emissions objectives.

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Note: The NSW Government released its Orderly Exit Management Framework in December 2023 to manage the end of life closures of coal fired power plants.[6] We will address the potential cost to NSW consumers of the option of retaining half of Origin Energy's 2.88GW Eraring coal fired power plant as a reserve capacity in a subsequent paper.

[6] NSW Government, Orderly Exit Management: Framework Consultation Paper, December 2023

SECTION 1 Recent Developments in Australia & NSW Accelerate Energy Decarbonisation

The last six months of 2023 saw a few profound developments in the Australian and NSW electricity markets and the political landscape that are helping drive the electrification of everything and putting Australia on track for a decarbonisation of our economy.

SECTION 1.1 Federal Developments

Climate and Energy Minister Chris Bowen significantly upgraded the Government's policy commitment to 82% renewables by 2030 and ambition with the 32GW Capacity Investment Scheme (CIS).

The 32GW Capacity Investment Scheme (CIS): In November 2023, Minister Chris Bowen announced the 32GW of CIS and the National Energy Transformation Partnership (NETP), in conjunction with the states, a scheme to underwrite and financially derisk projects so as to accelerate the deployment of BESS and renewables infrastructure projects using contracts for difference with a government sharing some upside.[7]

For context of the significance and scale of this initiative, the National Electricity Market (NEM) currently has an installed capacity of 64GW (71GW including the 7GW in the West Australian South West Interconnected System (SWIS)). Australia currently has 31GW of on-grid renewables and battery energy storage systems (BESS) (51GW including rooftop solar), so this one initiative alone will double our installed on-grid zero-emissions capacity, even as we continue to add >3GW pa of additional rooftop solar.[8]

The pull forward of development of firmed renewables across Australia will come at little if any net cost to Australian electricity consumers / taxpayers. If the CIS is triggered into paying the contracts for difference (CfD) revenue floor under the scheme – where, if there is a shortfall in revenue below the floor, the government makes up the difference, helping to cover project investors' operating costs and debt repayments – it means electricity consumers are seeing sustained lower power prices some 50% below the average wholesale prices for NSW in CY2023 of A$105/MWh, and a quarter of the CY2022's $198/MWh.

The pull forward of new renewables is also likely to reduce emissions for the NEM over the coming decade of >100Mt, worth $3-4bn to Australians as a whole even at the current depressed ACCU pricing.

Australia's COP26 Pledge: Minister Chris Bowen in December 2023 committed Australia to triple our renewable energy generation capacity and double average annual energy efficiency improvements by 2030,[9] very consistent with his government's 82% renewables by 2030 pledge.

NatHERS: The National Construction Code (NCC) 2022 commenced on 1 May 2023, with the new energy efficiency requirements of a new 7-star minimum and Whole of Home energy budget from 1 October 2023. The Nationwide House Energy Rating Scheme (NatHERS) is being funded by the Federal government to support this assessment of Australia's existing housing stock.[10] This was strongly supported by the commitment by Commbank to reduce their housing loan book emissions by 60% by

[7] Minister Bowen Media Releases, Government welcomes support for expanded Capacity Investment Scheme, 24 Nov 2023
[8] CEF, Federal Energy Minister Chris Bowen turbocharges Australia's move to 82% renewables, 23 November 2023
[9] Minister Bowen Media Releases, Australia supports global renewable and energy efficiency pledge, 3 Dec 2023
[10] NatHERS News - May 2023

2030.[11] Westpac following up with a 56% reduction by 2030 housing loanbook target,[12] building on the 59% emissions intensity reduction commitment by 2030 on commercial buildings, established by Westpac in FY22. Bank Australia has led the way with its target of a 64% reduction in housing loan book emissions intensity back in 2022.[13]

12% of Australia's total emissions come from housing and household decarbonisation is being driven by the decarbonisation of the electricity grid (emissions intensity is due to halve on the back of 82% renewables by 2030).

Brilliant efforts like the Gas Substitution Roadmap by Victorian Energy Minister Lily D'Ambrosio,[14] including banning gas connections to new houses from 2024, are driving electrification of everything and permanently reducing the energy costs of living. We continue to await NSW's efforts in this regard.

CSIRO / AEMO GenCost Report: CSIRO in December 2023 released its annual report into the cost of electricity generation in Australia, both for current and future deployment.[15] Yet again, the report highlights that renewable energy has the lowest cost range of any new-build technology, and in a period of high capital cost inflation, solar costs continue to buck the trend with ongoing deflationary cost trends. With a 45% decline in solar module export prices from China in 2023,[16] this trend will accelerate in the coming year.

[11] Renew Economy, Big banks take on greening of Australia's $10 trillion housing stock, 1 November 2023
[12] Climate Energy Finance, Westpac FY23 Climate Finance Assessment, 14 November 2023
[13] Bank Australia, One year closer to net zero by 2035, 20 Dec 2022
[14] Premier of Victoria, Jacinta Allan, Gas Substitution Roadmap Charts Path To Lower Bills, 14 Dec 2023
[15] CSIRO, GenCost: Annual insights into the cost of future electricity generation in Australia, December 2023
[16] PV Magazine, Famine to feast – China's solar market in 2023, 16 December 2023

SECTION 1.2 NSW Developments

NSW Climate and Energy Minister Penny Sharpe ended 2023 with a number of key achievements. Firstly, the Climate Change (Net Zero Future) Act 2023 was legislated with multi-party support, locking in a strong 70% emissions reduction by 2035 target. November 2023 saw completion of the Round 2 Tender under the Electricity Infrastructure Roadmap awarding 1,070MW of battery energy storage systems (BESS) and virtual power plants (VPP). December 2023 saw the Round 3 Tender awarded for 1,274MW of new wind, solar, BESS and compressed air energy storage (CAES). Round 4 is due to be awarded in June 2024.

The Climate Change (Net Zero Future) Act 2023: NSW in December 2023 passed its net zero emissions legislation with a staggeringly positive multiparty support.[17] This legislates a 50% emissions reduction target for 2030, 70% for 2035 and net zero by 2050, with a provision only allowing a ratcheting up of ambition and establishing an independent, expert Net Zero Commission. [18] A really positive move, that was then matched and beaten by incoming Queensland Premier Steven Miles, targeting a 75% emissions reduction by 2035. [19] [20]

Stronger Building Efficiency Standards: The Australian government brought in new rules for significantly enhanced building efficiency standards, reducing energy use by at least 20%. August 2023 saw the combined energy and climate crises, and housing affordability and cost of living issues impact NSW government policy, with a delay to the BASIX standards on new homes for nine months. [21] Sustainability standards for non-residential development came into effect from 1 October 2023. [22]

NSW Tender – Round 1 (awarded May 2023): NSW underwrote a minimum AEMO Services' Long-Term Energy Service Agreement (LTESA) contract price of ~$35/MWh for solar and ~$50/MWh for wind (~40% below the levelised cost of energy (LCOE), a massive win for NSW consumers), securing 1.4GW of new capacity across 2 solar projects, a 275MW wind farm (which received development consent in 2016, and then again in 2018, but is only due to commence construction by early 2024[23]) and the unprecedented RWE 50MW/400MWh long duration Limondale BESS – Figure 1.1: [24]

Figure 1.1: Round 1 Tender awarded May 2023

Project Proposal	Proponent	Technology	Capacity	Location
Stubbo Solar Farm	ACEN Australia	Solar	400MW	Central West Orana
Coppabella Wind Farm	Goldwind Australia	Wind	275MW	Southern Tablelands
New England Solar Farm	ACEN Australia	Solar	720MW	New England
Limondale BESS	RWE Renewables	BESS	50MW/400MWh	South West REZ

Source: Renew Economy

[17] NSW Government, NSW Climate and Energy Action, The Climate Change (Net Zero Future) Act 2023, Dec 2023
[18] Herbert Smith Freehills, NSW legislates short and long term targets to achieve net zero emissions by 2050, 21 December 2023
[19] Queensland Government, 75 by 2035: Queensland powers ahead with new emissions target, 15 December 2023
[20] CEF, Submission to the Legislative Council Portfolio Committee No.7 – Planning & Environment, 24 October 2023
[21] NSW Government, BASIX pause to help home buyers and builders, 15 August 2023
[22] NSW Government, Sustainability standards for non-residential development, 1 October 2023
[23] Goldwind, Coppabella Wind Farm Newsletter, November 2023
[24] Renew Economy, NSW gets stunning low price for wind and solar in biggest renewables auction, 1 May 2023

NSW Tender – Round 2 (awarded November 2023): The 1,075MW $1.8bn of projects awarded were a 500 MW, two hour BESS for the Liddell coal power plant site by AGL Energy, the 415MW, four-hour (1,660MWh) BESS proposed by BlackRock's Akaysha Energy at Orana in NSW's central west; a 65MW, two-hour battery at Smithfield in Sydney built by Iberdrola, and 90MW of demand response capacity – including three separate virtual power plants – by Enel X. [25]

All the projects must be built by December 2025, and all must be available to deliver at least half their capacity to any LOR3 events (a signal of potential supply shortfalls) that are declared by the AEMO. Round 2 was trebled in size from 380MW to 1,070MW as a result of the Federal Government's CIS after AEMO identified a potentially bigger supply gap after the Eraring closure.

AEMO Services executive general manager Paul Verschuer said all projects were also appraised on social licence commitments, deliverability and the organisational capability and capacity.[26]

Figure 1.2: Round 2 Tender awarded November 2023

Project Proposal	Proponent	Technology	Capacity	Location
Liddell BESS	AGL Energy	BESS	500MW 2hrs	Hunter Valley
Orana BESS	BlackRock's Akaysha Energy	BESS	415MW 4hrs	Orana REZ
Smithfield BESS	Iberdrola	BESS	65MW 2hrs	Smithfield Sydney
VPP	Enel X	DRM VPP	90MW >2hrs	n.a.

Source: Renew Economy, NSW Government's AEMO Services [27]

NSW Tenders – Round 3 (awarded December 2023): NSW has secured another $4.2bn in wind, solar and long duration storage projects. [28] Andrew Forrest's Squadron Energy will now go ahead and build the previously foreshadowed but delayed 450MW Uungula wind project near Wellington in the state's central west, which had already won a Snowy Hydro PPA, and was supposed to start construction in 2022 after receiving approval in 2021. Neoen will build the 350MW Culcairn solar project near Albury.

The average real price of these two renewable infrastructure projects is A$55/MWh for 20 years, locking in low cost electricity supply for NSW consumers.

Figure 1.3: Round 3 Tender awarded December 2023

Project Proposal	Proponent	Technology	Capacity	Location
Uungula Wind Farm	Squadron Energy	Wind	400MW	CWO REZ
Culcairn Solar Farm	Neoen Australia	Solar	350MW	Culcairn
Silver City Energy Storage	A-CAES NSW	Compressed air storage	200MW/8 hrs	Broken Hill
Golburn River BESS	Lightsource bp	BESS	49MW/8 hrs	Merriwa
Richmond Valley BESS	Ark Energy	BESS	275MW/8 hrs	Myrtle Creek

Source: Renew Economy

[25] Renew Economy, Liddell to host giant battery after AGL and Akaysha win Australia's biggest capacity tender, 22 November 2023
[26] AEMO, NSW tender for firming capacity exceeds expectations, 22 November 2023
[27] NSW Government, NSW tender for firming capacity exceeds expectations, 22 November 2023
[28] NSW Government, Further information on outcomes of Tender Round 3 for generation and long-duration storage infrastructure, 19 December 2023

Three long duration eight-hour BESS proposals were selected, interestingly winning ahead of pumped hydro storage (PHS), flow batteries and methane gas peakers – Figure 1.2:[29]

1. A 275MW/2,200MWh lithium-iron phosphate BESS to be built by Ark Energy, a subsidiary of Korea Zinc, in the state's north in the Richmond Valley, south of Casino; [30]
2. A 49MW/392MWh BESS by Lightsource bp at Merriwa in the upper Hunter Valley;
3. Canada's Hydrostor's previously announced 200MW/1,600MWh Silver City advanced-compressed air energy storage (A-CAES) 50-year life project at the Potosi silver mine site near Broken Hill to ease grid congestion driven curtailments on the existing local 200MW Silverton wind and 53MW Broken Hill solar projects, aiming to replace 2 aging imported diesel gensets by commissioning in 2027 (although we note the EIS is yet to be submitted and hence planning approval is yet to be obtained, and hence the proposal is yet to get to FID). This proposal is supported by a Transgrid contract as well as the Australian Renewable Energy Agency (ARENA) as a first of its kind in the domestic context. [31] [32]

NSW Tenders – Round 4: bids closed in December 2023 for the fourth capacity tender for 3,000GWh pa of new renewables generation supply, with results due to be announced in June 2024.[33]

The Central-West Orana (CWO) REZ Upgrade: December 2023 saw the NSW Government reconfirm its intention to boost the capacity of the CWO REZ around Dubbo from the original 3GW to reach 6GW by 2038, with an initial capacity of 4.5GW by 2027/28. [34] The government also confirmed that a consortium known as "Acerez", comprising Spain's Acciona, Cobra and Endeavour Energy will be the operator of the REZ, and be responsible for building, operating and maintaining the REZ transmission lines, energy hubs and other infrastructure. The CWO REZ is scheduled to reach FID in 1HCY2024 and commence construction in 1HCY2025 with operation in 2027-28, supporting and enabling up to $10bn of wind, solar and BESS.

NSW Department of Climate Change, Energy, the Environment and Water: From 1 January 2024, the Department of Planning and Environment will be split into two new dedicated entities, the Department of Climate Change, Energy, the Environment and Water, and the Department of Planning, Housing and Infrastructure.[35] Our hope is this will assist with removing planning approval roadblocks and delays.

[29] Renew Economy, NSW secures another $4.2 billion of wind, solar and storage to help shift from coal, 19 December 2023
[30] Renew Economy, World's biggest eight-hour lithium battery wins NSW long duration storage tender, 19 December 2023
[31] Renew Economy, Air storage pioneer inks first of its kind deal to keep lights on in Australia's Silver City, 8 December 2023
[32] ABC, Hundreds of jobs on horizon after green light from Transgrid for Hydrostor's compressed-air energy storage in Broken Hill, 8 December 2023
[33] Renew Economy, Disappointment as tender for access rights to NSW renewable energy zones delayed, 1 November 2023
[34] Renew Economy, NSW doubles size of Australia's first renewable energy zone, appoints operator, 20 December 2023
[35] NSW Government, Changes to the public sector to provide laser focus on housing and energy challenges, 18 August 2023

SECTION 1.3 New NSW Capacity Developments

Significant new wind, solar, BESS, gas peaking and grid transmission efforts were made over the last six months of 2023. After a very mixed year, the month of December 2023 was very strong, with the Independent Planning Commission (IPC) approving two new solar and BESS projects, the Oxley 215 MW solar farm, along with a 50 MW one-hour BESS, and the 200MW Glennellen solar farm. December 2023 saw the NSW government approve the Yanco Delta 1.5GW wind farm, along with a 800MW one-hour BESS – the first wind farm approved in NSW since 2021.

There is a significant and growing list of NSW capacity additions due by the closure of Eraring in 2025. Largely facilitated by the NSW Electricity Infrastructure Roadmap and Electricity Infrastructure Investment Act 2020, this includes BESS, wind and solar infrastructure projects, new gas peaking capacity and even some grid infrastructure progress.

Australia is leading the world in BESS deployments,[36] providing a clear rebuttal of the long-hyped furphy that grid reliability will be compromised by acting swiftly on the climate crisis as we replace end of life coal fired plant clunkers with increasing reliance on firmed renewable energy.

Wind and Solar Infrastructure

- ENGIE of France's slimmed down 290MW Hill of Gold Wind Farm in Nundle, New England, won NSW Department of Planning and Environment (DPE) approval in December 2023, leveraging existing grid transmission capacity, and is supported by a 100MW BESS. This wind farm approval is now subject to an Independent Planning Commission (IPC) assessment in 2024.[37]
- July 2023 saw the NSW government open public consultation on CWP renewables' 700MW Spicers Creek Wind Farm and BESS in the CWO REZ, designated State Significant Development (SSD).[38]
- August 2023 saw the NSW government approve Terrain Solar's 152MW Marulan Solar Farm and BESS near Goulburn and the 350MW Blind Creek Solar Farm and BESS near Bungendore.[39]
- December 2023 saw the NSW government approve the Yanco Delta 1.5GW wind farm by Belgian firm Virya Energy in the state's south-west REZ, along with a 800MW/800MWh BESS.[40]
- December 2023 also saw the IPC approve two new solar farm and battery storage projects, the $370m Oxley 215 MW solar farm, along with a 50 MW, one hour battery in the New England REZ on low grade 'class 5' land not suitable for cultivation, being built by China's Megawatt Solar,[41] and the 200MW Glennellen solar farm in the Riverina region, developed by China's Trina Solar. [42]
- December 2023 also saw France's Neoen give the final go-ahead to build the 350MW Culcairn Solar Farm in the Riverina region, supported by the Round 3 LTESA Tender win, with engineering, procurement and construction (EPC) by Bouygues Australia, expected to be operational in 2026. The project also has development approval in place for a 100MW / 200MWh BESS. [43]
- Acen Australia is set to commence construction of its first phase 400MW New England solar project in 2024 having won Round 1 LTESA in May 2023.[44]

[36] AFR, Why 2024 will be the year of the big battery, 2 January 2024
[37] Renew Economy, Hills of Gold: Contested New England wind farm wins planning approval, 14 December 2023
[38] NSW Government, Plans for new wind energy project on public exhibition, 28 July 2023
[39] NSW Government, Solar farm approvals to light-up almost 200,000 homes, 27 August 2023
[40] AFR, NSW approves its first wind farm in 2½ years. 22 December 2023
[41] Renew Economy, NSW approves big solar farm and battery near New England town of Armidale, 11 December 2023
[42] Renew Economy, Big solar farm in NSW approved after widening gaps in solar rows to allow more sheep, 16 December 2023
[43] PV Magazine, Neoen gives go-ahead for second largest solar farm in global portfolio, 22 December 2023
[44] Renew Economy, Australia's biggest solar farm reaches peak output, now to host 6,000 sheep, 12 December 2023

- China's Beijing Jingneng Clean Energy (BJEI) began construction of its 280MW Wollar Solar farm near Mudgee, NSW in February 2023 with an 18 month construction period expected.[45]
- January 2024 saw Squadron Energy commence construction of the 414MW Uungula Wind Farm in Wellington, NSW (deploying world leading 6MW onshore turbines from GW Verova) after winning the Round 3 tender in December 2023, proof the government support is crowding in private capital and helping enable projects to get underway. Squadron has an enormous portfolio pipeline of 14GW of renewable infrastructure projects.[46]

Battery Energy Storage Systems (BESS)

- The 850MW/1,680MW Waratah Super Battery (WSB) located at the site of the now closed Lake Munmorah power plant started its proposed two year construction phase in May 2023 and is due for commissioning in early 2025. This BESS is supported by an Australian Energy Regulator (AER) approved $700m payment over six years. Waratah BESS is owned by BlackRock's Akaysha Energy and supported by Powin, and will be the largest in operation in Australia on commissioning, albeit not for long. Melbourne Renewable Energy Hub (MREH), being developed near Melton jointly by Equis Renewables and the Victorian Government's State Electricity Commission (SEC), subsequently also started construction in 2023 and will be the biggest battery in Australia once developed to its full capacity of 1,200MW/2,400MWh.[47]
- Akaysha is also developing the Orana BESS near Wellington in central-west NSW, which will deliver a 415MW and up to 1600MWh big battery in two stages as part of the CWO REZ, with first stage commissioning due 2025, supported by the Round 2 tender win.[48] December 2023 also saw NSW approval for Akaysha's BESS near Wellington.
- AGL reached a December 2023 Final Investment Decision (FID) for its $750m 500MW/1,000MWh Liddell BESS, supported by $35m ARENA funding and a NSW LTESA (refer above), with Fluence as EPC provider. [49]
- AGL has a 50MW 1 hour BESS being commissioned currently at Broken Hill supported by Fluence and ARENA.
- Origin Energy has proposed a 2 phase 700MW/2,800MWh Eraring BESS, supported by Wartsila, and has commenced construction of phase 1.
- Octopus' 300MW/600MWh Blind Creek Lake George BESS has received planning approval and is due for commissioning in 2025, supported by the Clean Energy Finance Corporation (CEFC).
- Spark Infrastructure has a 500MW/1000MWh BESS originally slated for commissioning in 2025 alongside a solar project as part of the REZ.
- RWE of Germany has its 50MW/400MWh BESS adjacent to its existing 249MW Limondale solar project in the SW NSW REZ, with support from NSW's May 2023 long duration tender.[50]
- CWP has the 30MW/30MWh Sapphire BESS due online in 2024.
- Maoneng has the 50MW/100MWh Sunraysia BESS due for commissioning in 2023, supported by a contract from AGL Energy.
- July 2023 saw NSW approval for ACEnergy's Apsley 120MW/240MWh BESS near Wellington in the CWO REZ, set to cost estimated at $123m.[51]

[45] Wollar Solar Farm, Construction
[46] Press Release, Squadron Energy starts work on largest NSW wind farm: commits to 14GW renewables pipeline, powering six million homes, 11 January 2024
[47] Renew Economy, SEC makes first investment in "one of world's biggest" batteries in Melbourne, 30 November 2023
[48] Akaysha Energy, Orana BESS
[49] Renew Economy, AGL to begin construction of Australia's biggest "grid forming" battery in 2024, 19 December 2023
[50] Renew Economy, Eight hour big battery trumps pumped hydro in NSW long duration storage tender, 1 May 2023
[51] Renew Economy, NSW gives planning OK to two new big batteries in key renewable zones, 19 July 2023

- July 2023 saw NSW approval for Firm Power's $157m 150MW/300MWh BESS at Muswellbrook (Hunter Central Coast REZ) due to be operational by end 2025. [52]
- December 2023 saw NSW approval for Firm Power's BESS in Toronto near Lake Macquarie and a 170MW BESS located adjacent to Ausgrid's Beresfield Substation near Newcastle in NSW.[53]
- December 2023 saw the $12bn Snowy 2.0 PHS recommence operation of the Florence boring machine, after a 12 month delay. Commissioning is scheduled for December 2028.[54]

Methane Gas

- EnergyAustralia's 316MW Tallawarra B gas peaking power station on the shores of Lake Illawarra fired up for the first time in December 2023 and expects to be fully operational in early 2024.[55]
- EnergyAustralia's 400MW Tallawarra A gas power station is due for a 2024 upgrade to add an additional 40MW of capacity to 440MW. [56]
- Squadron Energy's Port Kembla Energy Terminal is due for completion in 2025-26.[57]
- Snowy Hydro's 660MW Hunter Power Project is due for commissioning in December 2024, 18 months late, and at A$1.2-1.5bn, double the original cost. Snowy pathetically failed to disclose the lack of gas pipeline connectivity.[58] and even post an expensive methane gas pipeline expansion, the facility will only have a 10 hours operating capacity maximum.[59]

Coal

- NSW citizens continue to wait for the NSW Environment Protection Authority (EPA) to implement current-century operating rules for NSW's remaining four coal-fired power plants. The statutory five-yearly review covers: air emissions limits for metals; the frequency of air and water monitoring; a commitment to improve monitoring and public access to information; and increasing community and stakeholder engagement by power stations.

  The key aspect is the continuing exemption of Delta Electricity's Vales Point from pollution limits. Reports show it is feasible for Delta to reduce its toxic nitrogen oxide emissions by 90% by installing long-overdue basic pollution controls. [60]

Grid Infrastructure

- ElectraNet announced the successful completion of the 900km South Australian component of the $2.3bn Project EnergyConnect, the new high-voltage transmission line between South Australia and NSW, marking a significant milestone in Australia's renewables landscape. This will facilitate initial power transfer of 150MW, rising to 800MW by mid-2026 on completion of stage 2.[61]
- October 2023 saw the Australian Energy Regulator reject a community group challenge to the $3.4bn VNI West interconnector, a new 500 kV double-circuit transmission line connecting high voltage grids

[52] NSW Government, Green light for two new batteries to help secure power for 100,000 homes, 19 July 2023
[53] Firm Power, BERESFIELD BATTERY ENERGY STORAGE
[54] PV Magazine, Florence machine resumes tunnelling on Snowy 2.0 pumped hydro project, 14 December 2023
[55] Renew Economy, Newest peaking gas plant fires up for first time: At least it's connected to a pipeline, 19 Dec 2023
[56] EnergyAustralia, Tallawarra A High Efficiency Upgrade
[57] Renew Economy, Forrest backtracks on "filthy" fossils, supports development of gas terminal, 12 January 2024
[58] Renew Economy, Another dud Snowy Hydro project, squandering $1.5bn of taxpayers' money, 6 Dec 2023
[59] Renew Economy, Newest peaking gas plant fires up for first time: At least it's connected to a pipeline, 19 Dec 2023
[60] Newcastle Herald, Power stations under the pump to clean up emissions, 21 December 2023
[61] PV Magazine, ElectraNet completes SA stretch of EnergyConnect, 22 December 2023

in NSW and Victoria, proposed by AEMO Victoria Planning and Transgrid.[62]

[62] PV Magazine, Regulator dismisses community dispute of VNI-West interconnector, 17 October 2023

SECTION 1.4 NSW Electricity Modelling - Updated

We have updated CEF's NSW electricity model for the actual CY2023 results. Total renewable energy share (utility scale wind and solar, rooftop solar and hydro) was a record high 31.3% in CY2023, up from 28.9% in CY2022, having more than doubled in the last five years. But the major warning we drew from the results was that while electricity demand grew, it was by just 0.6% yoy, below our +1.0% forecast, but well below AEMO's +2.7% annual compound growth rate (CAGR) forecast through to 2030 and beyond. High prices suppressed demand, but we note AEMO is overly focused on grid reliability and under focused on energy affordability, particularly in a year consumers were smashed with combined energy, climate and cost of living crises.

We have updated CEF's NSW electricity model for the actual CY2023 results, as reported by OpenNEM.

Relative to CY2022, NSW's electricity system evolved rapidly:

- Net electricity imports of 6.4 terawatt hours (TWh) were 1.5TWh or 31% higher than CY2022.
- Black coal generation of 43.5TWh was 2.7TWh or 5.8% lower, mostly reflecting the closure of Liddell coal fired power plant from April 2023, a multi-decade low share down to 58.5% in CY2023.
- Methane gas electricity generation dropped 42% or 1.0TWh to just 1.4TWh, giving gas a decade low market share of just 1.9% for CY2023 (3.3% in CY2022) due to the hyper-inflation of gas prices.
- Hydro generation was down 0.2TWh or -5% yoy, with a CY2023 4.5% share (4.6% in CY2022).
- Utility scale renewables were up 1.0TWh or+ 9% yoy with a CY2023 share of a record 16.3% (15.0% in CY2022) as new capacity additions kicked in, masking a lower wind capacity factor.
- Rooftop solar generation was up 1.8TWh or 31% yoy for CY2023, delivering a record high 10.3% share (7.9% share in CY2022).
- Total renewable energy share (utility scale wind and solar, rooftop solar and hydro) was a record high 31.3% in CY2023, up from 28.9% in CY2022, having more than doubled in the last five years.
- Total NSW electricity demand was 74.5TWh in CY2023, up 0.4TWh or +0.6% yoy. Importantly, this is below CEF's forecast growth of July 2023 of 1.0% pa, but as we stressed at the time, just a quarter of the CAGR AEMO has modelled for NSW from 2023-2030 of 2.7% pa. Extreme fossil fuel driven price inflation of >20% pa for the last two years has clearly seen a demand response.

CEF's CY2030 Projection of Electricity Demand Growth

We assume a materially lower annual growth rate in total electricity demand of +1.0% relative to AEMO's +2.7% p.a. This is a key assumption, and we stress test it against the -0.2% CAGR seen in the last two decades.

Whilst increased EV penetration and electrification of everything will boost demand, energy efficiency will likely offset much of this growth. AEMO's demand shortfall risk assessment is materially overstated if demand growth continues to come in below their forecast assumptions.

In the US, there is view that electricity demand will accelerate from the 0.5% pa of the last decade to 1.0% pa over the coming five years, but the biggest factors driving this acceleration is the massive boost to US manufacturing underpinned by US$481bn of new and committed investment on the back of the US Inflation Reduction Act, and the expected US$150bn investment by 2028 in new US data centres. We note that NSW has not seen any electricity demand growth over the last 20 years, so our 1% pa growth assumption looks optimistic vs the US electricity demand growth expectations identified here.[63]

[63] Canary Media, Suddenly, US electricity demand is spiking. Can the grid keep up? 20 December 2023

Figure 1.4: CEF's NSW Electricity Model of Demand and Supply (Annually, TWh)

Calendar Year	Total Demand TWh	Total Demand annaulised	Total RE Generation TWh	Rooftop included in Total RE	RE Share (utility + rooftop)	Rooftop share	NSW Fossil fuel share	Coal Share	Coal power TWh
2011	77.8	0.0%	2.6	0.4	3.4%	0.5%	86.9%	82.2%	63.9
2012	73.8	-5.1%	4.6	0.6	6.2%	0.8%	82.6%	77.0%	56.8
2013	71.3	-3.4%	4.5	0.8	6.3%	1.1%	86.8%	80.7%	57.5
2014	71.0	-0.4%	3.3	0.9	4.6%	1.3%	82.1%	76.7%	54.4
2015	71.8	1.2%	4.9	1.2	6.8%	1.6%	81.7%	76.2%	54.7
2016	72.5	0.9%	7.5	1.4	10.4%	1.9%	78.5%	74.9%	54.3
2017	73.2	1.0%	6.0	1.5	8.2%	2.1%	82.8%	78.8%	57.6
2018	73.3	0.2%	9.1	2.2	12.3%	3.0%	80.1%	78.3%	57.4
2019	74.1	1.1%	10.7	3.0	14.5%	4.0%	79.3%	76.6%	56.7
2020	72.6	-2.0%	12.8	3.8	17.7%	5.2%	74.0%	72.5%	52.7
2021	72.3	-0.5%	16.5	5.0	22.8%	6.9%	69.6%	68.2%	49.3
2022	74.0	2.5%	20.5	5.9	27.7%	7.9%	65.7%	62.4%	46.2
2023	74.5	0.0%	23.1	7.7	31.1%	10.3%	60.4%	58.5%	43.5
2024	75.2	1.0%	26.8	9.2	35.6%	12.3%	56.9%	54.8%	41.2
2025	76.0	1.0%	25.6	10.8	33.7%	14.2%	55.6%	53.2%	40.4
2026	76.7	1.0%	32.5	12.4	42.3%	16.1%	47.1%	44.7%	34.3
2027	77.5	1.0%	39.4	13.9	50.8%	18.0%	38.7%	36.3%	28.2
2028	78.3	1.0%	41.0	15.5	52.4%	19.8%	37.3%	34.9%	27.3
2029	79.1	1.0%	42.6	17.1	53.9%	21.6%	35.9%	33.5%	26.5
2030	79.9	1.0%	50.3	18.6	63.0%	23.3%	26.8%	24.5%	19.6

Source: Climate Energy Finance

Capacity Changes in NSW

We factor in the loss of 12TWh pa on the phased closure of the 4 units at Eraring around August 2025, and the closure of Vales Point in 2029, cutting a further 7TWh pa of coal fired power generation.

CEF forecasts continued 1.2GW annual additions of rooftop solar across NSW, such that the performance of 2023 (generation growing +31% yoy) compounds up, and share increases from 10.3% in CY2023 to 23.3% in CY2030 as aggregate installed capacity more than doubles. This will be led by the commercial and industrial (C&I) segment, which to-date has been capped by the federal small scale renewable energy scheme (SRES) limit of 100 kilowatt (kW) systems. CEF recommends a tenfold increase in this limit.

We assume methane gas' share increases with the addition of Tallawarra B and Kurri Kurri, adding an insignificant combined 0.5TWh pa given assumed annual utilisation rates of just 5%.

In addition to the extra cumulative 11TWh (+1.6TWh pa) of rooftop solar generation added over the coming 7 years, we factor in 16TWh (+2.6TWh pa) of additional cumulative utility scale renewables generation. This equates to 1.0GW pa of new utility scale renewables (down from our July 2023 estimate of 1.2GW pa needed due to the better than expected CY2023 performance. This is entirely achievable, and should with any serious ambition, be well exceeded as REZs start to come onstream.

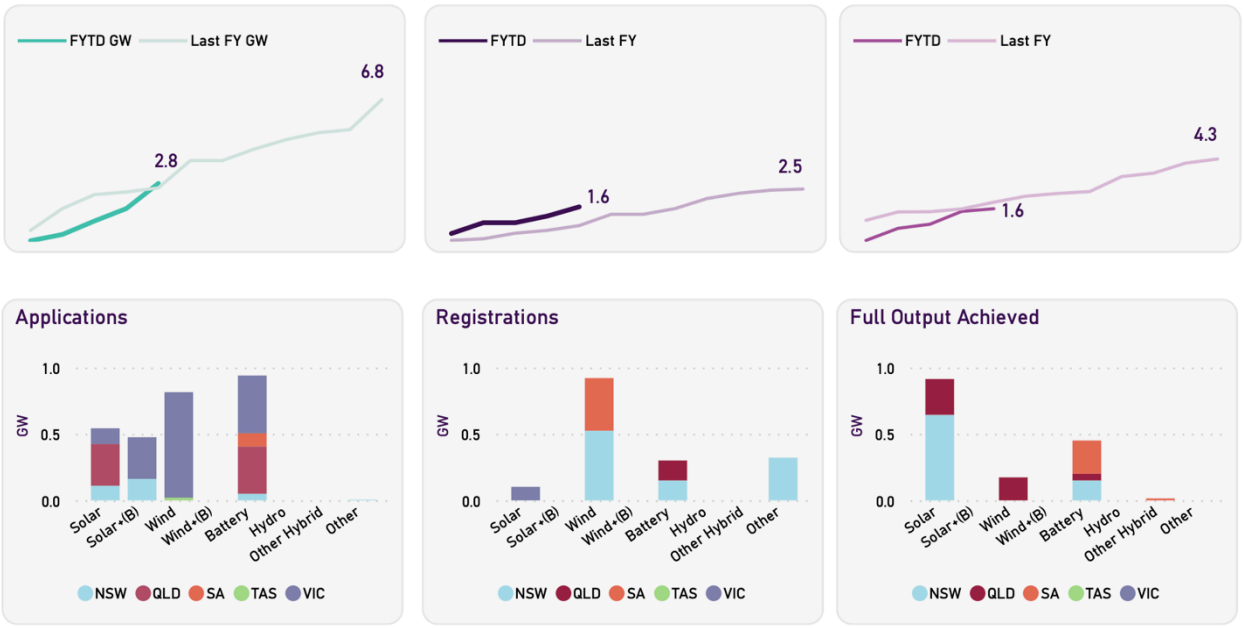
SECTION 1.5 NEM Connections Scorecard

AEMO reports Australia has 250GW of new generation and BESS project proposals in the pipeline. The absolute priority is getting more regulatory and more grid connection approvals, rapidly.

January 2024 saw AEMO provide its NEM Connections Scorecard to the end of November 2023.[64] AEMO reports that during November 2023, 6 projects totalling 1.21 GW received application approval and moved into the pre-registration stage, bringing the FY2024 year-to-date total to 19 projects (2.77 GW).

Four projects, totalling 0.45 GW completed registration, bringing the fiscal year to date (FYTD) total to 11 projects (1.64 GW). One project (0.13 GW) commenced operating at full output in November, increasing the FYTD total to 12 projects (1.55 GW) – Figure 1.5. AEMO highlights there is no shortage of investor proposals, totalling over 250GW, in the pipeline across the NEM.[65]

Figure 1.5: NEM Approved/Registration/Commissioned FY2024 To-Date GW in relation to last FY2023



Source: AEMO NEM Connections Scorecard

We note the NEM needs approvals, registrations and commissionings to all increase by at least 50% on average over the coming six years to deliver on the Federal Government's target of 82% renewables by 2030. We note that Figure 1.5 is on-grid investment activity, with the consistent and growing addition of another 3GW pa of behind the meter rooftop solar installs adding to the NEM total.

The additional 32GW CIS boost should underpin a significant increase in activity across the NEM, as noted in Section 1.3 above. AEMO reports as of November 2023 there are 80 projects going through the applications process totalling 20GW, another 72 projects in pre-registration totalling 12GW, 9 projects in registration totalling 2GW and 16 projects in commissioning phase adding another 2GW – 36GW in total – with another 399 project inquiries behind this.

There is a wall of capital available, and more than enough project proposals – in NSW, as in Australia

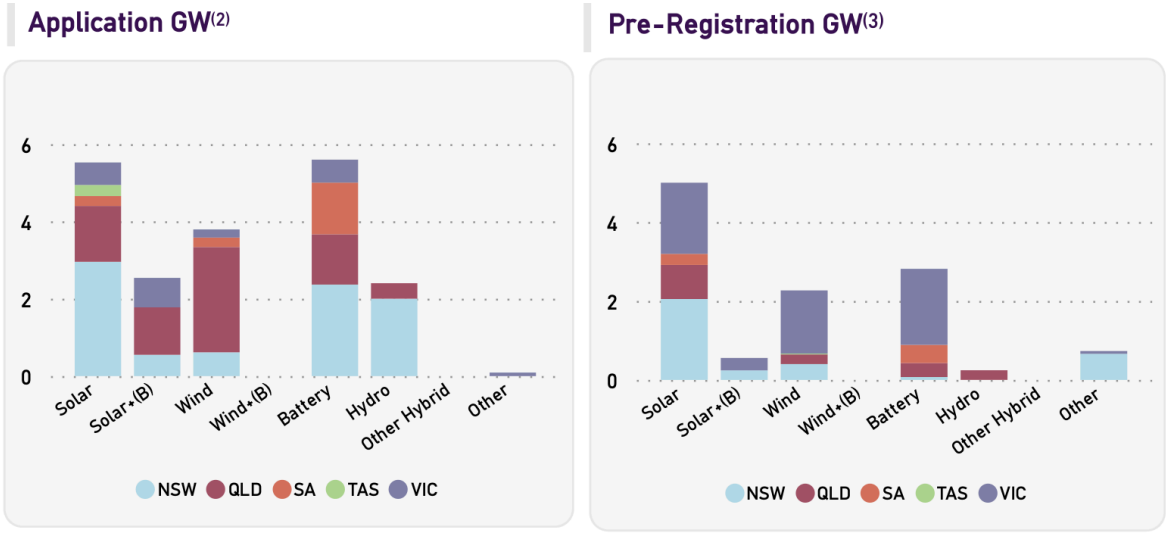
[64] AEMO, NEM Connections Scorecard, 2 January 2024
[65] AEMO, CEO speech at Macquarie Green Energy Conference, 21 November 2023

overall, we need planning approvals and grid connection inertia to be overcome.

Figure 1.6 details that NSW has the leading share of new applications (43%) and second highest share of pre-registration project proposals (at 40%) across the NEM as of November 2023.

However, with one of the slowest approval processes in our country, the NSW government needs to make some drastic changes to its planning and approvals process. As per Section 1.3, December 2023 was a very promising month for NSW, and we need to see that improvement maintained.

Figure 1.6: NEM Applications & Pre-Registration by State (as at November 2023, GW)



Source: AEMO NEM Connections Scorecard

New Grid Transmission Approvals

We note the ongoing media storm over development of new grid transmission projects, partly reflecting vested interests whipping up community concerns, but also due to a lack of adequate local community benefit sharing.

CEF would reference the need for the NSW government to adequately explore existing grid capacity to accommodate new infill wind and solar projects, leveraging new grid capacity modelling technologies by the likes of Neara[66] and more realistic engineering assumptions.[67]

Similar conclusions have been reached in other markets facing new grid transmission approval delays. The US Department of Energy's Office of Technology Transitions outlined the potential in a December 2023 webinar for dynamic line-rating systems, which use sensors to determine when temperature and wind conditions can enable power lines to carry more electricity than their conservative "static" ratings would indicate, increasing effective capacity by an average of 10 to 30% over 90% of the time. [68]

Progress to 82% Renewables by 2030

[66] Businesswire, Neara Closes US$24M Series B to Mitigate Utilities' Climate Risks and Accelerate Renewable Energy, 27 September 2023
[67] AFR, How AI unlocked capacity across NSW's energy grid, 22 February 2023
[68] Canary Media, Could 2024 be a breakout year for the transmission grid? 3 January 2024

The Australian government has a clear target and policy regime to deliver on its 2023 election pledge of 82% renewables by 2030. The progress to-date is solid, with renewables reaching a 38.6% share in CY2023, up 3.7% on 34.9% in CY2022, which was up 3.5% on CY2021 after a 4.8% increase on CY2020.

However, this 4.0% annual share increase needs to increase by 50% to 6.0% pa increased share for the remaining 7 years till 2030 to reach 82%. The newly expanded CIS of 32GW is a massive policy win to help deliver on the required step-up in public and private investment.

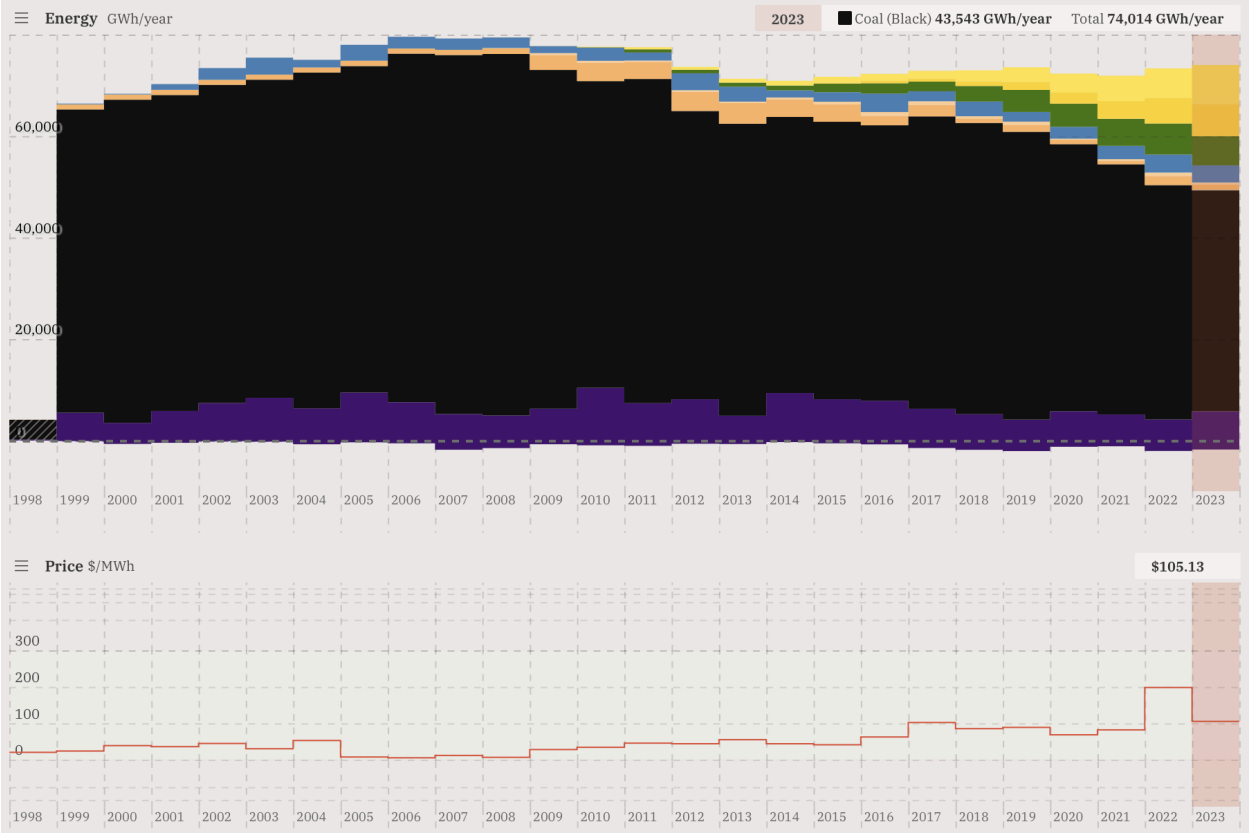
SECTION 1.6 NSW Electricity Pricing

NSW saw wholesale electricity prices drop 47% yoy to average $105/MWh in CY2023, with 4QCY2023 averaging -40% yoy to $72/MWh. After two years of ~20% pa retail electricity price increases, CEF expects the Default Market Offer to drop double digits come 1 July 2024.

NSW wholesale electricity prices in CY2023 dropped 47% to average A$105/MWh vs the record high average of $198/MWh in CY2022 – Figure 1.7.

The 4QCY2023 saw NSW wholesale prices moderate further, averaging A$72/MWh, -40% yoy relative to the $122/MWh in 4QCY2022, and down 77% on the record high quarter reached in 2QCY2022 of A$321/MWh, just before the NEM collapsed for a week due to skyrocketing gas and thermal coal commodity prices and the increasing unreliability of end-of-life-coal plants.

Figure 1.7: NSW Electricity Fuel Mix and Pricing, 1998-2023



Source: OpenNEM

Retail Pricing

May 2023 saw the AER set the NSW Default Market Offer (DMO). From 1 July 2023 residential customers on standard retail plans saw price increases of 21-24% without controlled load, depending on their region, and 20-25% with controlled load (smart meters and CER). Small business customers also saw increases of 15% to 29%, depending on their region.[69] This added to the 9-18% increases for NSW residential customers and 4-14% increases for small businesses from 1 July 2022.

[69] AER, AER releases final determination for 2023–24 Default Market Offer, 25 May 2023

With the wholesale price representing ~30% of the retail price, everything else being equal, we should be looking at a double digit retail price reduction in the DMO come 1 July 2024, barring any new significant fossil fuel commodity price spikes. Given the enormous cost of living pressures from rampant fossil fuel energy price inflation over the last two years, and the consequent increase in general inflation and hence mortgage rates, this augurs well for some overdue relief mid 2024.

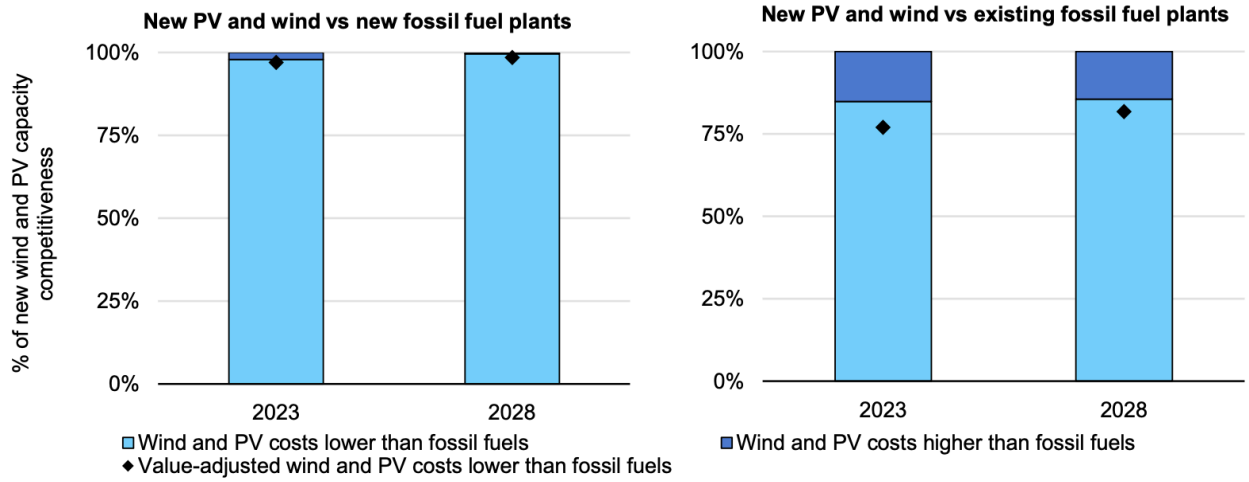
Unlike Queensland, NSW is still to see any increase in coal royalty rates, given the implementation of the NSW government's 2023 policy announcement that it will increase royalties was deferred till July 2024, a massive missed opportunity for additional one-off revenue inflows to finance temporary energy bill relief for those most suffering from energy poverty in the state.[70]

The idea spouted by a few gentailers and climate and energy luddites that the DMO should increase to compensate energy firms for the massively lower price of wholesale electricity pricing due to the low cost nature of solar is ridiculous.[71] The idea that this undermines the investor appeal in gentailer business models is likewise ludicrous, given the statement comes after the titanic $20bn bid for control of Origin Energy by Brookfield thwarted by AustralianSuper,, a year after the battle for control of AGL Energy. Far from undermining the value of the retailing business, it illustrates how strategically important it is for accelerating the energy transition. The role of rooftop solar and CER more broadly is key to this technology disruption.

IEA Renewables 2023 Report

January 2024 saw the IEA Renewables 2023 Report,[72] with the clear conclusion that even with supply chain disruptions and rising interest rates, renewable energy is increasingly the low cost source of electricity capacity globally, for both new capacity and increasingly against even existing fossil fuel plants – Figure 1.8. We note this is after grid firming, but it ignores the cost of carbon emissions from the historic fossil fuel competitors to wind and solar firmed by BESS.

Figure 1.8: NSW Electricity Fuel Mix and Pricing, 1998-2023



Source: IEA Renewables 2023 Report

[70] The Guardian, 'Massive missed opportunity': NSW could make $23bn with tiered tax on record coal profits, 21 September 2022
[71] The Australian, Broken power system still fuelled by calls for subsidy, 3 January 2024
[72] IEA, Renewables 2023: Analysis and forecasts to 2028, January 2024

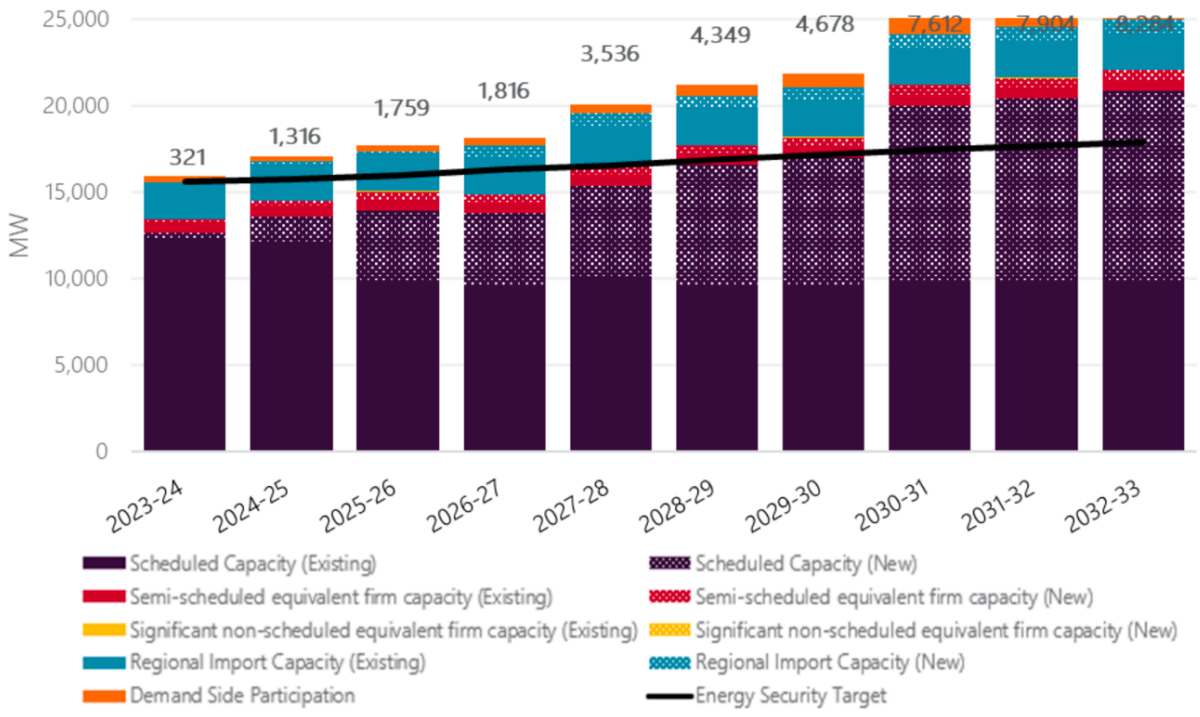
SECTION 2 NSW Reliability Gap

AEMO reports that if the Federal and State government delivers on its key projects, NSW has no reliability gap in any year in the coming decade, even in 2025/26 when the hyper-expensive, high emissions, end of life 2.88GW Eraring coal-fired power plant retires. The NSW Government's Peak Demand Reduction Scheme is an important initiative that is lowering the cost in improving grid reliability. The overwhelming issue is the NSW Department of Planning and Environment's approval delays. We hope to see improvements with the restructure of this department effective 1 January 2024.[73]

AEMO's Energy Security Target Monitor Report of October 2023 shows that once Federal and state schemes sensitivity are included, there is no NSW reliability gap forecast in any year this coming decade, notwithstanding the on time closure of Eraring in 2025 – Figure 2.1. [74]

This sensitivity includes the impacts of the HumeLink and New England Expansion transmission projects. and anticipated generation and firming projects already committed to under various federal and state government schemes and programs, notably further projects under the NSW Government's Round 2 of November 2023 (all of which are expected to be completed in advance of summer 2025-26 and hence Eraring's closure) and Round 3 December 2023 tenders which deliver much needed medium term certainty of replacement and new generation and firming capacity over the coming 2-3 years.

Figure 2.1: NSW Electricity Security Target, FY2024-FY2033



Source: AEMO Energy Security Target Monitor Report, October 2023

[73] NSW Department of Planning and Environment, 1 January 2024
[74] AEMO Energy Security Target Monitor Report, October 2023

Delays on completion and grid connection of these tender winners' projects could see a single year shortfall of 757MW in FY2026 – the year of Eraring's closure – but only if:

1. AEMO electricity demand growth projections are accurate – when CEF and history would suggest these are overly aggressive, as discussed in Section 1.4;
2. AEMO's underestimates the positive growth of grid orchestration schemes, several of which are already well underway – Section 3;
3. The NSW government fails to implement a new program to accelerate fast deployments of behind the meter storage and/or lift the 100kW SRES limit on C&I rooftop capacity (refer Section 3) and/or fails to incorporate demand response management services (as seen in Round 2); and
4. Project developments that have progressed sufficiently to be classified by AEMO as anticipated are incorporated into the assessment (an AEMO recommendation to be incorporated from 2024).

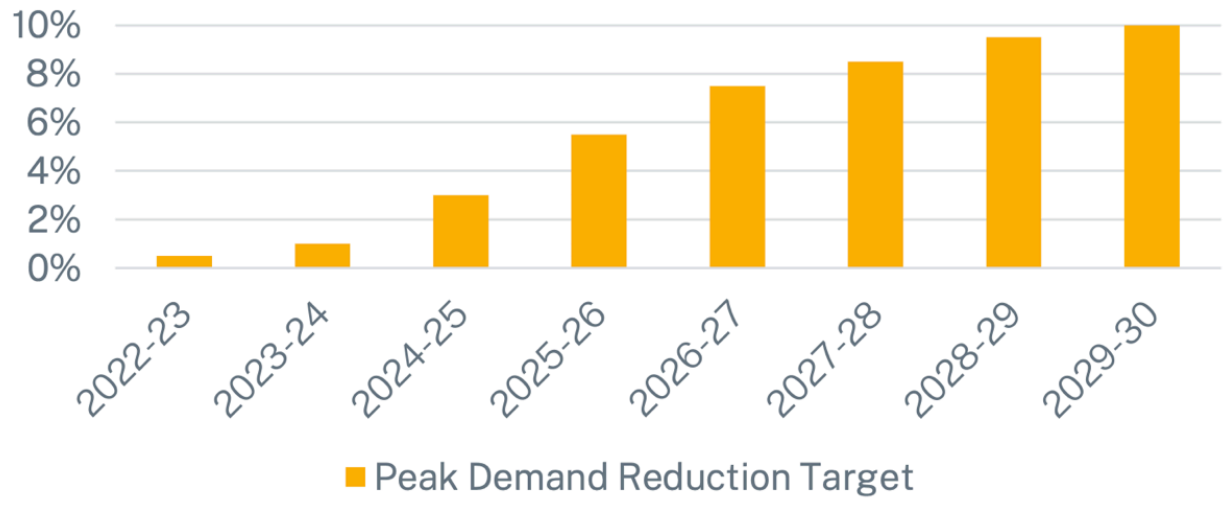
Peak Demand Reduction Scheme

We note AEMO has assumed the continuation of the NSW Government's Peak Demand Reduction Scheme, introduced in 2020, which provides financial incentives to households and businesses to reduce energy consumption during hours of high peak demand. The scheme started with a demand reduction target of 0.5% in 2022 and aims to increase to 10% by 2030.

We strongly endorse this program and note an accelerated investment in the rollout of smart meters and more appropriate time of day retail pricing tariffs would permanently and positively change consumer behaviours at this time of energy poverty.

This program covers residential and commercial air conditioners, commercial heat pump water heaters, refrigeration cabinets and residential pool pumps. While the wholesale demand response mechanism is in place, the lack of awareness and incentive means just 33MW of capacity has registered to-date.

Figure 2.2: NSW Peak Demand Reduction Target, FY2023-FY2030



Source: NSW Government, October 2023

AEMO states: "By reducing demand for electricity at times when demand is high, we will reduce the risk of power outages and reduce pressure on wholesale electricity prices across NSW. In addition,

households and businesses across NSW could also save a total of $1.2 billion on their bills between 2022 and 2040." [75]

By improving the flexibility around when electricity is used, we will also be able to use more renewable energy generation in the system. This will help NSW reduce emissions by 70% by 2035 and achieve net zero by 2050.

Coal Power's Increasing Unreliability

The week-long collapse of the NEM in June 2022 was a direct product of the planned and unplanned outages of a third of the NEM's coal fleet, as well an unprecedented gas and coal commodity price hyperinflation.[76]

AEMO's Energy Security Target Monitor Report calculates that 1,385MW of reserve margin capacity (10% of NSW firm total capacity) is needed to cover the loss of the two largest available generating units within the state, currently Mount Piper Power Station 1 (with 705 MW summer peak rating) and Eraring Power Station Unit 2 (with 680 MW summer peak rating). As these two end of life coal plants retire over the coming six years, the reserve margin will progressively reduce, reflective of the increased grid reliability that comes with more but smaller generation capacity facilities.

New Replacement Capacity Approvals

NSW Energy Minister Penny Sharpe said the winning projects of Round 2 are equal to 8% of the total 2022/23 NSW summer peak demand and are critical for energy security in NSW: "We have no time to waste as coal-fired power stations retire. We must get more renewable energy into the grid – backed by storage and flexible demand – to keep the lights on and meet our net zero targets." Asked at a press conference about whether the winning projects would fill the gap, Sharpe said they "go some way to that. We still think that there is going to be a reliability gap that we're going to have to deal with, but this puts a big, big – really fills the big hole there."[77]

The obvious solution to the projected shortfall in new capacity is for the NSW government to fix its planning approvals process to reduce the current roadblocks and inertia, which see approval timelines 2-3 times longer than other states, adding 4-7 years to project progression and up to 25 times more expense.[78]

A December 2023 report by the Clean Energy Investor Group (CEIG)[79] found that for the previous five years, approval timeframes in NSW for major clean energy development applications (DAs) averaged:

- 746 days for State significant development (SSD) projects
    - 3488 days for wind
    - 705 days for solar
    - 530 days for battery
- 492 days for Critical State Significant Infrastructure (CSSI) projects (including hydro and transmission)

Moreover, the very high planning application costs for renewable generation projects in NSW are not reflective of the assessment costs incurred by the Department of Planning and the Environment and

[75] NSW Government, The 2023 Peak Demand Reduction Scheme Consultation
[76] Australian Energy Council, AEMO Market Suspension Report: Anatomy of a Crisis, 25 August 2022
[77] Renew Economy, Liddell to host giant battery after AGL and Akaysha win Australia's biggest capacity tender, 22 November 2023
[78] Renew Economy, "A decade is far too long:" Major investors slam planning delays in NSW, 14 December 2023
[79] Herbert Smith Freehills / CEIG, Delivering Major Clean Energy Projects for NSW, 14 December 2023

associated agencies. NSW is the only state to levy application fees that are dependent on project capacity and value. This means, for example, that a 1.5 GW project attracts a fee of $4.5m, 150 times the cost of the same capacity project in Queensland.[80] The solutions are clear and well articulated in the CEIG report.

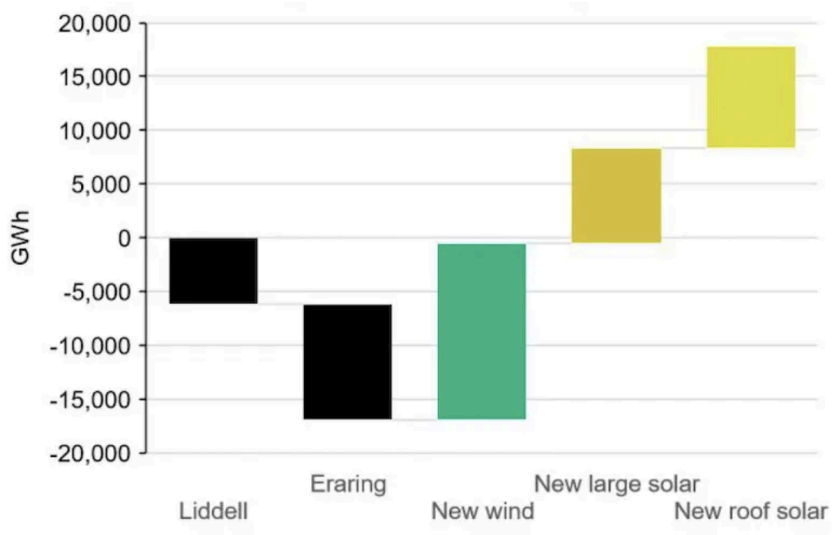
It was very heartening to see the first signs of tangible progress emerge in December 2023.Announcing the approval of 1.5GW wind farm,Minister Sharpe predicted an uptick in renewable energy construction in 2024 after a new "whole of government" approach to the state's looming energy crisis has prompted better collaboration in planning and across departments, saying "Renewable energy developments like this one … are critical to our energy future."

The key area of blockage is planning, so it was positive to see Planning Minister Paul Scully flagging that a raft of renewable energy projects would get the green light in 2024, and saying that: "2024 is set to be an even bigger year with 18 projects under assessment in the pipeline."[81]

The message that building renewables and firming capacity should be a key priority to ensure energy security and slash prices seems to have belatedly landed – hopefully in time that NSW taxpayers won't have to fork out hundreds of millions in compensation to Origin Energy to keep 2 units of Eraring open for an additional 1-2 years.[82]

Green Energy Markets (GEM) analysed the exit of coal power generation relative to new utility scale wind and solar andplus rooftop solar additions at the level of the NEM (albeit GEM notes this ignores interstate grid transmission capacity constraints – hence why our CEF report focuses on is done at the NSW state level). and It found there is more than sufficient replacement capacity – Figure 2.3:

Figure 2.3: NEM Electricity Generation Waterfall, 2022-FY2026



Source: Green Energy Markets Analysis, December 2023 [83]

IEEFA's modelling in its December 2023 report, "The approaching surge of renewables and storage leaves

[80] Smart Energy Council / CEIG / Nexa Advisory, Letter to the NSW Government, 24 October 2023
[81] AFR, NSW approves its first wind farm in 2½ years, 22 December 2023
[82] Renew Economy, Mind the gap: Will Penny Sharpe use her new powers to force Eraring to stay open?, 21 December 2023
[83] Renew Economy, Do we really need Eraring when we'll have more big batteries by 2026?, 1 December 2023

no space for Eraring", found there is likely to be no reliability gap in NSW assuming, and any government subsidies to Origin Energy would likely just see other existing coal fired power plant utilisation rates decline, and beyond 2025, a significant number of additional projects will likely be commissioned beyond those that assumed by AEMO.[84]

The Role of Gas

Methane gas fired power generation represented a small, important but declining role in the NSW and NEM in CY2023. For NSW, gas generation was just 1.43TWh or 1.9% of total for CY2023, down from 3.3% in CY2022 and from its high of a 5-6% share a decade earlier.

Like BESS, pumped hydro storage (PHS), demand response management (DRM), Peak Demand Reduction Scheme, V2G and interstate grid transmission, methane gas will play a role in firming up the ever higher share of low cost, zero emissions but intermittent renewable energy in NSW.

EnergyAustralia's Tallawarra B in the Illawarra region is due to be commissioned in 1QCY2024, and construction continues on the taxpayer-funded Kurri Kurri gas peaking plant in the Hunter, belatedly due on line in 2024/25 once new gas pipelines have been built (refer Section 1.3).

Gas will continue to play an important but progressively diminishing role in grid firming and reliability, given these plants are likely to run just 1-5% of the time due to the high cost of gas vs the ever increasing range of lower cost, zero-emissions technology alternatives.

CEF strongly advocates that NSW taxpayers not be required to subsidise new gas supply or its enabling, long life pipeline infrastructure, as these are inevitably stranded assets to-be once we have an effective price on carbon pollution.[85]

[84] IEEFA, The approaching surge of renewables and storage leaves no space for Eraring, 14 December 2023
[85] AFR, 'No need to be defensive about gas': NSW Energy Minister, 8 January 2024

SECTION 3 Consumer Energy Resources (CER)

A highlight of 2023 was the 3.17GW of rooftop solar installed across Australia, the second highest rate ever. AEMO has made significant commentary on the solar duck curve and minimum grid demand issues. It is beyond time NSW had a solar soaker price signal in the middle of the day to encourage consumer behaviour to shift electricity use to when electricity supply is plentiful, and dirt cheap or even free. Grid orchestration is a key technology opportunity to limit grid gold-plating.

The November 2023 Energy and Climate Change Ministerial Council (ECMC) focused on the CIS and the National Energy Transformation Partnership, the need for accelerating the connection of new generation projects, energy reliability contingency plans and supported AEMO's efforts to increase both participation in demand response mechanisms.

Importantly, the ECMC agreed to develop a National Consumer Energy Resources (CER) Roadmap – Powering Decarbonised Homes and Communities – to unlock consumer benefits for locally generated and stored power, deliver national reforms for efficient and effective CER integration, deliver on emissions and renewable energy commitments, and drive positive outcomes for all consumers, regardless of income, and the system as a whole.

Ministers agreed to give consideration to implementing a national approach to technical regulatory settings for consumer energy resources in 2024, aligned with reducing cost of living impacts on households, enhancing household and business solar and other distributed energy generation and storage, increasing the contribution of CER toward renewable energy targets, reducing costs, and maximising the benefits and opportunities of increasing EV usage. They agreed to the establishment of an expert taskforce to deliver priorities under the Roadmap.[86]

ARENA funded Project Symphony in Western Australia and AEMO's Project Edge pilot in Victoria for CER orchestration highlights that over $5bn could be saved if we coordinate solar, batteries, EVs and energy uses like hot water that are distributed across the entire country. Efficient buildings can be heated and cooled outside of peak times because they can maintain their temperature for many hours. Batteries might cost 20-40c/kWh but many of the other options will cost only a few cents/kWh.[87]

Rather than having AEMO demand new powers to regularly curtail solar generation, we should instead prioritise a "solar soaker" price tariff that is triggered whenever minimum on-grid demand is approached,[88] likely to be predictably almost every day in summer across Australia.

Amber Electric offers a very effective price incentive to its retail customers. Octopus Energy has become the #2 electricity retailer in the UK by offering to charge all its customers EVs and BESS for free every time the wholesale power price goes negative. Origin Energy has deployed this software across Australia, so should be readily able to do this here, relatively quickly, if we only had smart meters – refer below).

Rather than Minister Sharpe appealing to electricity users to cut back on electricity use on a really hot and sunny day when solar generation is rampant, she should instead ask everyone to pre-aircondition their houses via an automatic price signal and text alert to anyone who opts in to save money.[89] A prerequisite should be they can't live in a 1 star NatHERS rated house or apartment, because they leak like sieves.

We note the use of the term CER as being largely consistent with Distributed Energy Resources (DER).

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[86] Energy and Climate Change Ministerial Council, Meeting Communique, 24 November 2023

[87] Renew Economy, How to stop wasting cheap renewables – and drive a faster transition, 8 January 2024

[88] The Conversation, As Australia's net zero transition threatens to stall, rooftop solar could help provide the power we need, 9 January 2024

[89] ABC, Households across NSW told to reduce electricity usage tonight as temperatures soar, 14 December 2023

The system benefits and rapid growth in generation opportunities for CER are clear, as is the need for stronger regulatory support.[90]

CER - Rooftop Solar Systems

Rooftop solar installs in Australia in CY2023 reached 3.17GW, +14% yoy and just below the 3.23GW record set in CY2021.[91] The average residential rooftop solar system reached almost 10.5kW in the month of December 2023, the largest on record, SunWiz's data shows. SunWiz also estimates Australian households added ~60,000 home batteries in 2023, or a fifth more than in the previous year.

The AER reports that consumer electricity exports in FY2023 accounted for more than 8% of the NEM supply (noting that only 68% of CER have smart meters able to record these exports, up from 56% in FY2021). [92] The AER also reports that electricity distribution network service providers (DNSPs) invested just 1% of their capex in support of CER, instead using their regulatory powers to curtail and limit supply of this rapidly growing zero-emissions, low cost supply source.

Across the NEM in FY2023 there were 2.8 million export customers, representing 25% of 11 million total customers. Of these export CER customers, 99% are rooftop solar, and just 3% have BESS. A clear guide to the merits of a supportive state government policy and the underlying direction of consumer preference to be largely self-sufficient and hence protect themselves from rampant electricity price hyper-inflation, Evoenergy (of the ACT) and SA Power Networks have the highest proportion of customers with batteries of all DNSPs in FY2023, at 11% and 9% penetration respectively.

For NSW, CER exports range from a low of 5% for Ausgrid, to 8% for Endeavour Energy and 10% for Essential Energy, well below Australia's leading DNSPs, those being Victoria's AusNet Services at 18% and South Australia's SA Power Networks at 16% share.

Smart Meters & Inverter Standards

We note and strongly endorse the Australian Energy Market Commission's (AEMC) metering review targeting a 100% rollout of smart meters in the NEM by 2030.[93]

Whilst since 2010 all rooftop solar customers are required to have a smart meter, the increased prevalence of the duck curve has turned power pricing signals on their head, meaning wholesale power prices are increasingly negative during the day. This creates a critical need to modernise pricing signals for all electricity consumers to include cost reflective time-of-day tariffs which could immediately and materially reduce the cost of living burden on consumers willing to adapt their energy use behaviours. This would disproportionately benefit lower income households given their significantly higher share of disposable income allocated to energy costs.

Figure 3.1 also shows why solar feed-in-tariffs need to be limited to be fair for all consumers, given solar exports are concurrent across the NEM and increasingly only occurring at times of low to negative wholesale NEM prices.

We also note the AER is allowing network tariffs on customer exports for all DNSPs by 2026. Whilst this could be equitable, the rise and rise of utility scale BESS is seeing rapidly rising investor interest due to the availability of low cost solar electricity daily for discharge again each evening peak. This will serve to ensure all electricity users share the benefit of CER in terms of lower cost zero emissions electricity. CEF would advocate against DNSPs yet again gaming the regulator to their benefit whilst retarding the much

[90] IEEFA, Growing the sharing energy economy, 13 October 2023
[91] The Guardian Australia, Australian homes three times more likely to have solar panels than a pool as energy prices surge, 4 January 2024
[92] Australian Energy Regulator, Export services network performance report 2023, 20 December 2023
[93] AEMC on smart meters: 100% by 2030, new customer information, real-time data & protections, 30 August 2023

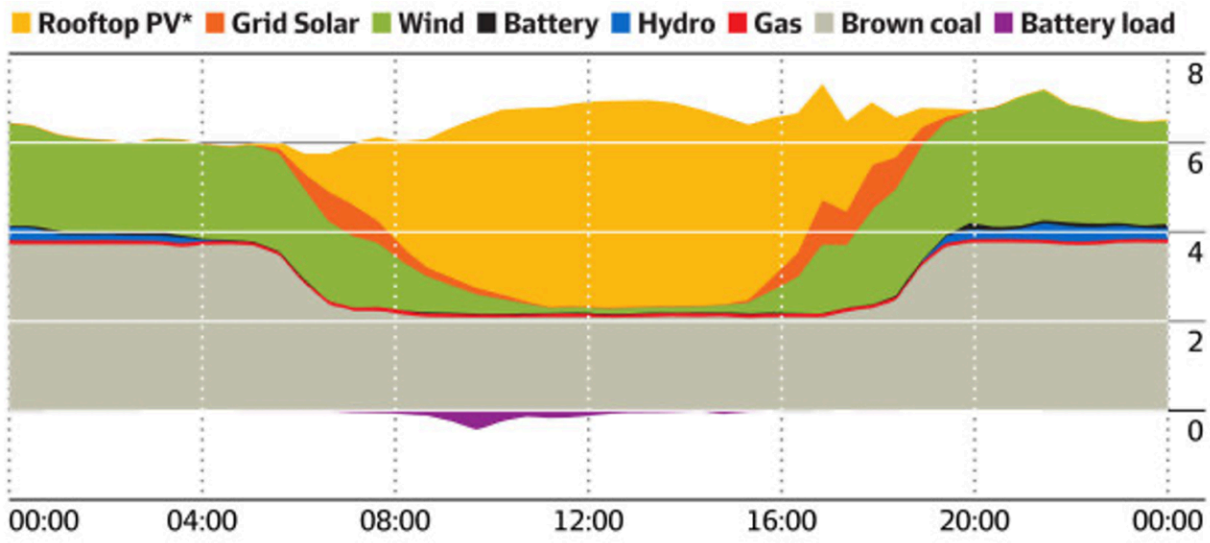
needed energy transition consistent with the climate science, particularly at a time of massive ongoing delays to expensive interstate grid transmission buildouts.

Australia needs all the new electricity capacity it can deploy as fast as possible, and CER is the #1 solution to this need, whilst batteries on wheels (EVs) will likewise provide massive improvements to grid reliability and time shifting of demand and supply of electricity if the AER can serve all Australian energy consumers ahead of the needs of largely foreign sovereign wealth funds.

Figure 3.1 shows how rooftop solar is already making AEMO very focused on addressing minimum ongrid electricity demand from 8am to 6pm daily, particularly during summer. This in turn means negative wholesale power prices across the NEM daily, which in turn is incentivising BESS at an ever increasing rate to time-shift supply into the evening peak (this also highlights how wind is predominantly generating overnight, complementing solar). We note that AEMO's latest Integrated System Plan (ISP) models CER capacity quadrupling to 86GW in the next 26 years to 2050, becoming by far the largest generation capacity resource in Australia.

We note that China completed a six year 380 million nation-wide smart meter rollout back in 2018 (with bulk ordering halving the per unit cost, standardising the technology in the process), which has grown to 437 million by 2020,[94] showing how far behind global leaders Australia has slipped in the last decade.

Figure 3.1: Victorian and South Australian Electricity Generation, 31 December 2023 ('000 MW)



Source: WattClarity, Australian Financial Review [95]

We note that the proposed Australian/New Zealand Standard 4777 for inverters is a key step towards enabling the system to prepare for V2G. [96] As a finance thinktank, this is outside the expertise of CEF, but we encourage the government to talk to the experts, starting with the Electric Vehicle Council.

Grid Orchestration

We continue to recommend the NSW government work with AEMO to encourage the accelerated

[94] Smart Energy International, APAC to hold lion's share of smart meters market through 2025, 10 Aug 2021
[95] AFR, Wind, solar farms give way to rooftop solar 'juggernaut', 3 January 2024
[96] The Driven, Inverter standards revised in big deal for solar and vehicle-to-grid technology, 21 December 2023

deployment of grid orchestration to build grid reliability even as renewable energy continues to increase.

It is noteworthy that the major gentailers are moving to implement strategies in this area.

AGL Energy in November 2023 highlighted its progress in reaching 1.1GW of decentralised assets under orchestration, including contracts with the Portland, Victoria, and Tomago, NSW, aluminium smelters, which have demand response mechanisms, with a FY2027 target of 1.6GW. Initiatives in relation to demand response and orchestration include AGL's Peak Energy Rewards program as one of the largest flexible demand response programs in Australia, now expanded to 120,000 customers. During FY23, AGL commenced hot water orchestration trials that are generating interest from customers and have the potential to provide significant flexible capacity. AGL continues in scaling its Energy as a Service solution.[97]

Origin Energy in October 2023 provided an update on its investment in leveraging its Octopus Energy Kraken consumer platform in building a market-leading virtual power plant service (VPP), which now has 343,000 connected services including home batteries, EVs and hot water systems. These can all be aggregated and orchestrated to help optimise supply and demand in the grid, allowing Origin to share benefits with customers, and helping to avoid unnecessary investment in centralised energy infrastructure. The VPP is scaling rapidly with more than 1GW of capacity, and Origin targets growth to 2GW. [98]

Vehicle to Grid (V2G) Charging

December 2023 saw Tesla announce that all of the company's EVs will have bidirectional including V2G charging by 2025.[99]

January 2024 saw China's National Development and Reform Commission (NDRC), call for the creation of initial technical standards governing new energy vehicle integration into the grid by 2025. NDRC called on cities to implement time-of-using pricing for residential charging points. By 2025, NDRC said it would set up over 50 pilot programs in regions where conditions for vehicle-grid integration are relatively mature.[100] Full implementation is expected by 2030. [101]

Ausgrid emphasises the need for tariff reform to change consumer behaviour and ensure that V2G becomes a smart grid enabler, rather than a problem. In March 2023 Ausgrid CEO Marc England stated: "You don't need to charge your EV every day, and you don't need to charge a car at 6pm. There are ways of distributing that demand and making sure you don't have to build the grid for the biggest moment of the biggest day." [102]

We see V2G as a key opportunity for a smart electricity system to strengthen grid reliability and lower the cost of electricity for all consumers, and call on the NSW Government to demand regulatory upgrades to prepare for V2G charging. With EV charging infrastructure nearly doubling across Australia in 2023, and set to do so again in 2024, the inevitability of transport electrification is now clear.[103]

As a January 2024 report on the UK regulatory focus on electricity decarbonisation and modernisation by The Economist concludes, "the best way to minimise … risks is to maximise the amount of efficiency that can be squeezed from the existing grid."[104] That is the fastest solution for NSW as well, in our view.

Energy Efficiency and Social Housing Upgrades

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[97] AGL Energy, 2023 Annual General Meeting, 21 November 2023
[98] Origin Energy, CEO Address – Annual General Meeting, 18 October 2023
[99] Thecooldown.com, Tesla confirms new game-changing feature coming to its cars by 2025, 20 December 2023
[100] Reuters, Beijing targets vehicle-grid integration to manage power demand amid EV ramp-up, 5 January 2024
[101] CNEPOST, China issues guidelines for vehicle-grid interaction, aims for NEVs to be mobile energy storage facilities, 4 January 2024
[102] Renew Economy, EV won't blow up the grid, says head of Australia's biggest network company, 13 March 2023
[103] Canberra Times, Electric car charging stations tipped to double again, 16 January 2024
[104] The Economist, The Great Rewiring: Britain needs an unprecedented expansion of the electricity grid, 4 Jan 2024

The January 2024 $206m social housing energy savings initiative for 30,000 disadvantaged households and Solar Banks is great to see.[105] This Federal-NSW investment in energy efficiency and electrification for social housing promises to deliver major bill savings. Upgrading an average home from a 1-star energy efficiency rating to a 3-star rating can cut energy consumption by as much as 30%, helping to drive decarbonisation and to address the cost of living pressures for those most in need.

[105] Renew Economy, Solar banks and electrification: Governments invest $206m to close the energy gap, 15 Jan 2024

SECTION 3.1 Electrification of Everything

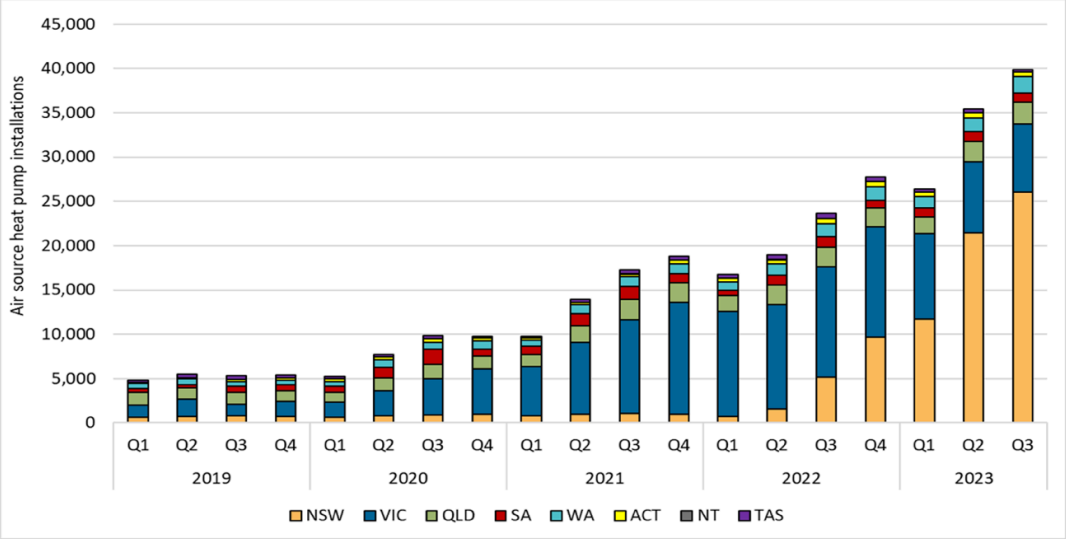
For all the talk of skilled labour shortages and supply chain disruptions, it was staggering to see the booming domestic market for air source heatpumps in Australia with 71% yoy growth reported in 9MCY2023, and NSW leading the uptake with a 58% share nationally to-date in 2023 (up from just a 13% share in the previous corresponding period).

The November 2023 Energy and Climate Change Ministerial Council reported on the progress of the National Energy Performance Strategy. This included progress on the Nationwide House Energy Rating Scheme, the National Framework for Disclosure of Residential Energy Efficiency Information, and policy options for the 2025 update of the National Construction Code,[106] as discussed in Section 1.1.

Australian consumers who can afford to make the upfront investment continue to protect themselves from the energy price hyperinflation generated by fossil fuel vested interests that have profited from the last two years of 20%+ annual retail electricity price rises. Installed national rooftop solar PV capacity grew 16% year on year to 2.22GW in 9MCY2023, with the total added capacity for CY2023 tracking towards a record 3.2GW of installs, equal to the best previous year (seen in 2021).

Figure 3.2 shows the booming Australian market for air source heatpumps with 71% year-on-year growth reported in 9MCY2023 to 101,646 units, with NSW absolutely leading the uptake with a 58% share nationally to-date in 2023 (up from just a 13% share in the previous corresponding period).

Figure 3.2 Australian Heatpump Installs by State (Quarterly)



Source: Clean Energy Regulator [107]

It was excellent to see the December 2023 announcement by Ministers Chris Bowen, Catherine King and Jenny McAllister of $100m in Round 1 grant co-funding for Community Energy Upgrades by Councils across Australia at community, cultural and sporting facilities, supporting investments in energy-saving measures, such as replacing swimming pool heating systems with electric heat pumps, battery storage at sporting fields, and installing EV chargers for council fleets.[108]

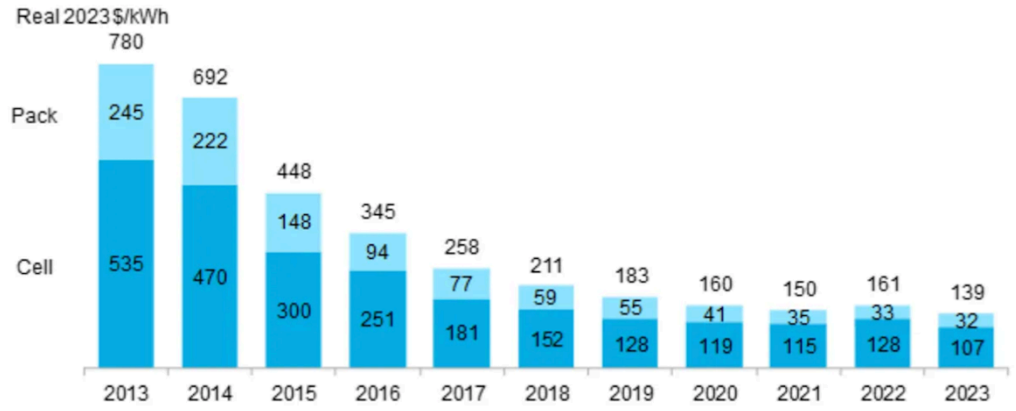
[106] Energy and Climate Change Ministerial Council, Meeting Communique, 24 November 2023
[107] CER, Quarterly Carbon Market Report, September Quarter 2023
[108] Australian Government, Joint media release: Grants open to help councils save on energy bills, 21 Dec 2023

SECTION 2.2 BESS

BloombergNEF estimates global BESS costs have fallen 80% in the last decade, and fell another 14% in 2023. Despite the climate luddites' furphy about the intermittency of low cost, zero emissions renewable energy, the combination of ever-lower cost variable renewable energy and BESS firming is far exceeding even the most bullish forecasts, and makes the electrification of everything and decarbonisation of the electricity grid a key enabler of Australia's Net Zero Emissions objectives.

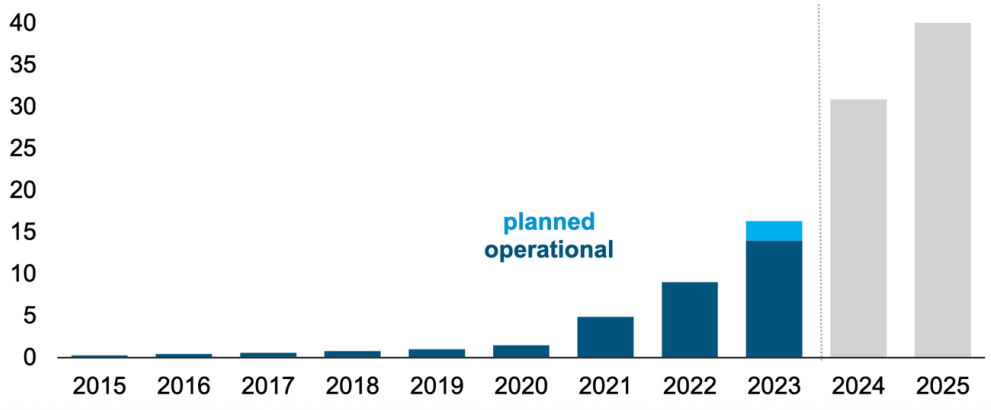
Australia is at the front of the global trend towards a massive scaling up of deployments of battery energy storage systems (BESS). With Chinese battery cell prices halving over 2023, the overall cost of BESS systems has fallen significantly (Figure 3.3), with further gains to come this year. The US Solar Energy Industries Association forecasts US BESS demand to grow sixfold by 2030 to 119GWh, whilst total battery manufacturing capacity in the US is forecast to grow tenfold to 630GWh (both for EV & BESS).[109] Cumulative US BESS installs are forecast to double in 2024 to more than30 GW – Figure 3.4.

Figure 3.3 Volume-weighted Average Lithium-ion Battery Pack and Cell Prices, 2013-2023



Source: BloombergNEF

Figure 3.4 U.S. cumulative installed battery capacity (GW)



Source: Energy Information Administration [110]

[109] PV Magazine, Building a U.S. battery supply chain, 2 January 2024
[110] EIA, U.S. battery storage capacity expected to nearly double in 2024, 9 January 2024

As noted above, May 2023 saw construction commence on the world-leading 850MW/1,680MWh Waratah Super Battery, only for this to be trumped in October 2023 by the commencement of the 1,200MW/2,400MWh BESS at the Melbourne Renewable Energy Hub (MREH), a $1.9bn development owned by Equis, and backed by Abu Dhabi Investment Authority and the Ontario Teachers Pension Plan Board.[111] Equis has also announced plans to develop its 300MW/1,200MWh Calala BESS near Tamworth, NSW, and is responding to submissions to its Environmental Impact Statement (EIS) as an SSD.[112]

NSW has a raft of world scale BESS in development beyond the WSB, with BESS under construction at Broken Hill (AGL), Eraring (Origin), Goulburn River (bp Lightsource), Liddell (AGL), Myrtle Creek (Ark Energy), New England (UPC/AC), Orana (Akaysha Energy) and Smithfield (Iberdrola). [113]

The NEM saw the May 2023 completion of the Riverina and Darlington Point BESS of a combined capacity of 150MW/300MWh, the largest to-date operating in NSW, while Genex's Bouldercombe 50MW/100MWh BESS in Central Queensland was commissioned in December 2023, built on time and on budget. The Waratah BESS is >5-6 times these two biggest operating batteries today, and MREH is 30% larger again than Waratah, showing the scaling up that is happening real time.

[111] PV Magazine, Equis' 2.4 GWh battery in Melbourne secures federal approval, 11 October 2023
[112] Equis, Calala Battery Energy Storage System
[113] Renew Economy, Big Battery Storage Map of Australia

Appendix 1: Major NSW Electricity Projects

The NSW Government's End of Year Snapshot 2023 highlights the progress to-date on major NSW Electricity projects, with first power for the 2.5GW South West REZ expected in 2026 as the first REZ to be energised, whilst the Waratah Super Battery is expected to be commissioned in 2025.

Figure A1 Major NSW Projects

Project	Intended maximum network capacity	Development status								
		REZ declaration	Preliminary transmission corridor	Network operator procurement	Access scheme declaration	Authorisation/ cost determination	Planning approvals	Financial close	Construction	Operation
Central-West Orana REZ	3-6 GW*	✓	✓	⚙	✓	⚙	⚙			
New England REZ	8 GW	✓	✓			⚙				
South West REZ**	2.5 GW	✓	✓		⚙		✓	✓	⚙	
Hunter-Central Coast REZ	1 GW	✓	⚙	⚙		⚙				
Illawarra REZ	1 GW	✓								
Hunter Transmission Project (Stage 1)	5 GW		✓	⚙		⚙				
Waratah Super Battery	0.9 GW			✓		✓	✓	✓	⚙	

Not applicable In progress Complete

Source: NSW Government End of Year Snapshot 2023