# Independent response to ACCC question

## Ad Hoc Report

david.dixon@rystadenergy.com

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# Cover letter

- I have been retained by Allens to inform its legal advice to Brookfield Renewable Group Australia Pty Ltd (Brookfield).
- In a letter of instruction dated 24 August 2023 I was asked to address the following question under, s 90(6)(b) of the Competition and Consumer Act 2010 (Cth)
  - *Based on your training, study and experience, you are requested to provide your opinion in writing (and the reasons for it) on question 1 of the ACCC Information Request, insofar as it relates to the likelihood that Australia will meet its goal of 82% renewable generation for the NEM by 2030. We understand that Rystad does not have expertise to comment on the emissions target aspect of the question.*
- This report is my response to the above question.
- I have read and had regard to the Federal Court of Australia Practice Note GPN-EXPT Expert Witnesses in Proceedings in the Federal Court of Australia, including the Harmonised Code of Conduct.
- All the opinions expressed in this report are my own.

Source: Rystad Energy research and analysis

# Annexure list

| Annexure | Description | File name |
|---|---|---|
| 1 | Signed letter of instruction | Annexure 1 - Signed letter of instructions - Project Eos (ACCC information request) - Rystad Energy.pdf |
| 2 | Rystad commentary on challenges to meeting 2030 target published on 25 / 05 / 2023 | Annexure 2 - Rystad Energy Commentary - 375881 - Batteries a key mid-term solution for decarbonizing Australia's NEM.pdf |
| 3 | Rystad commentary on approvals plummeting, published on 04 / 07 / 2023 | Annexure 3 - Rystad Energy Commentary - 379333 - Storm ahead_ Australia's wind, solar project approvals plunge 75% since 2018.pdf |

Source: Rystad Energy research and analysis

# Qualifications / Experience

1. I have a Bachelor of Petroleum Engineering (Honours) from the University of Adelaide (2007-2010) and a Masters in Photovoltaic Engineering from the University of New South Wales (2017-2018).
2. Prior to working in the power and renewables industry I worked in the oil and gas industry as a petroleum engineer from 2011 to 2016 for Shell and Woodside.
3. I joined Rystad Energy as a renewables analyst in 2018 covering the Australia market. Rystad Energy is an independent research firm focused on the energy sector headquartered in Norway, with offices in 28 locations around the world. Our coverage includes (but is not limited to) oil & gas, coal, energy supply chains, hydrogen, batteries, power& renewables. The focus of our solutions is collecting and analysing asset level data focusing on a bottom up approach.
4. I have worked on Rystad Energy's Australia coverage of utility solar, wind, batteries, pumped hydro and hydrogen electrolysers project data since 2018. This includes tracking metrics for every project above 1 $MW_{AC}$. Metrics for each project include (but are not limited to):
   a) Project Timelines: Key project milestone dates, development status
   b) Capacity: $MW_{AC}$ , $MW_{DC}$ , MWh, Capacity Factor
   c) Technology: Type of plant (PV, wind, batteries, pumped hydro etc), module type, module power, Wind turbine type, capacity etc
   d) Stakeholders: Equipment manufacturers (Panels, tracking, inverters, batteries etc), developers, EPCs, PPA counterparties
   e) Geography: Country, state/province, latitude / longitude
   f) PPA Data: PPA Duration (yrs), PPA Volume, PPA counterparties, PPA Price
   g) Economics: CAPEX, OPEX, NPV, IRR
5. Our client base consists of equipment suppliers (solar panels, trackers, inverters, wind turbines), project developers, engineering procurement construction companies (EPCs), banks, oil & gas companies, mining companies, consulting firms ,integrated generator / retailers & government bodies.
6. I have written reports and analytics commentaries on the Australia market since 2019, covering a diverse range of trends related to the renewables industry in Australia, including but not limited to, the growth of the pipeline of projects, construction & commissioning issues, asset generation performance, project economics, market share of equipment suppliers, power purchase agreements, price forecasts, auction results etc.

Source: Rystad Energy research and analysis

# New South Wales, Queensland & Victoria state targets

Australia's 82% renewables by 2030 target for the NEM is outlined in the Powering Australia plan which was introduced by the federal Labor government in 2022 and is supported by policies at a state and federal level.

At a state level, the largest electricity markets of New South Wales (NSW), Queensland (QLD) and Victoria (VIC) all have medium-term targets for new renewable energy supply and associated storage.

**Queensland**

The target is for 22 gigawatts (GW) of new utility PV and wind will be constructed through to 2035. Along with 7 GW of pumped hydro and transmission upgrades from south to north (500 kilovolt/kV network).

**Victoria**

The target is for 6.3 GW of storage will be constructed by 2035 and 9 GW of offshore wind by 2040. The state also benefitting from several intra-state/interstate transmission upgrades. These include VNI West and Marinus Link

**New South Wales**

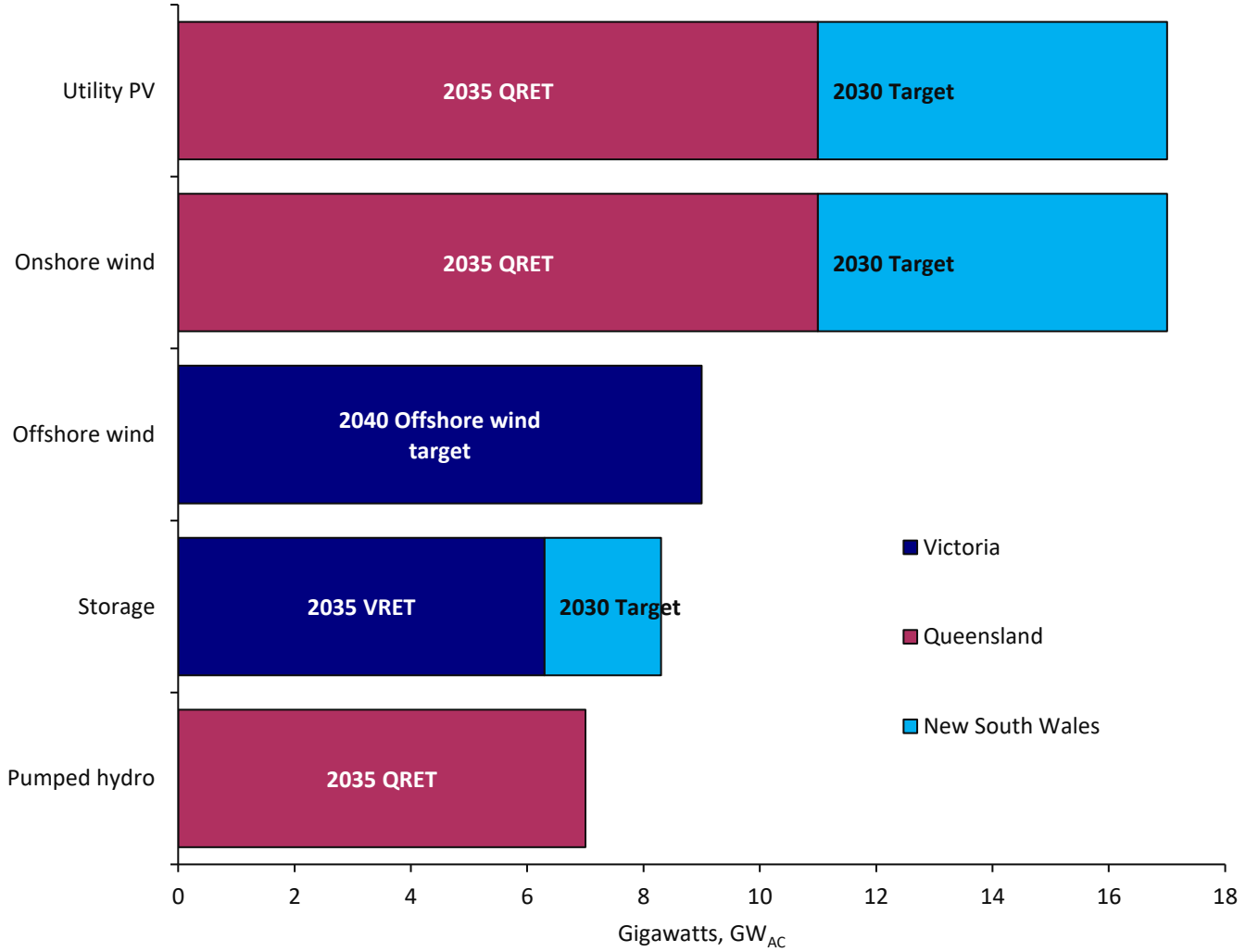
The target is for 12 GW of utility PV/wind and 2 GW of storage will be constructed by 2030.

**Large-scale Renewable Energy Target (LRET)**

Designed to deliver 33 terawatt hours (TWh) of additional renewable generation annually between 2020-2030. Accredited generators can create large-scale generation certificates (LGCs) for electricity generated from that power station's renewable energy sources. Over 33 million LGCs are required to be surrendered each year in addition to certificates that are voluntary surrendered. The target was met in January 2021 on a 12-month rolling basis. As such little value to no value is modelled for LGCs long term by new renewable projects, thus it is no longer an incentive for new development.

**Targets for renewables, pumped hydro and storage to 2040**

Gigawatts (GW)




Source: Rystad Energy research and analysis

# NEM modelling to 2030 – Unlikely to reach 82% by 2030

Rystad energy has performed independent modelling of Australia's National Electricity Market (NEM) to determine the impact on generation, prices and emissions. The key conclusions are presented below.

**Generation:** The NEM is expected to reach 82% renewables in 2035, five years later than current government expectations, but still an extremely fast transition.

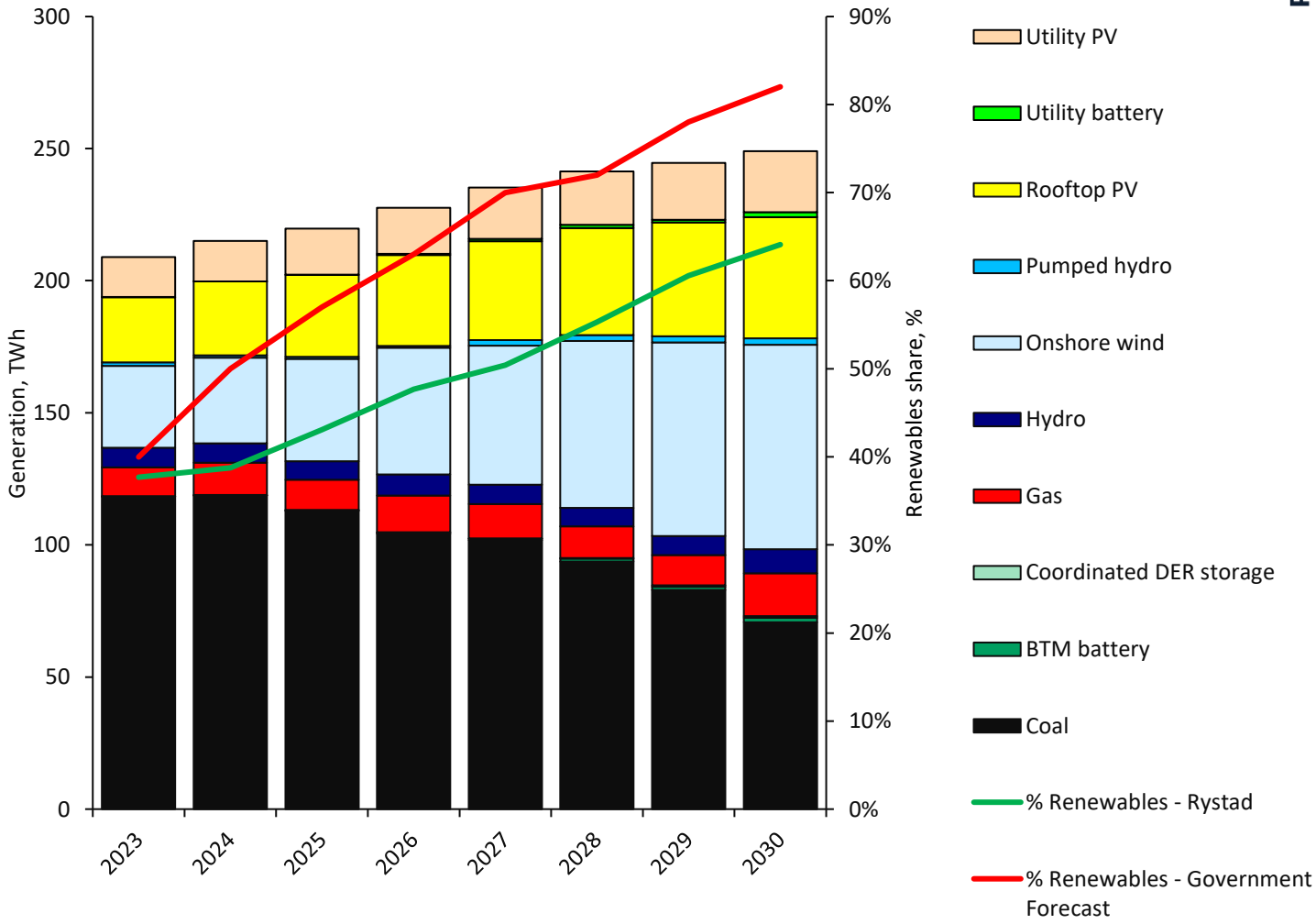
**Prices:** The price outcome (in real terms) shows the 15 years to 2038 will be volatile as most coal facilities retire. Post-2040 there are very little coal facilities left and prices become less volatile.

**Emissions:** Relative to 2023, emissions reductions in the NEM will decline over 80% by 2040 in line with coal exits. Emissions from gas will remain relatively flat at 10 Mt CO2e with some fluctuation in line with year-to-year fluctuations in gas generation.

**Four critical unknowns**

- Coal plant reliability: Unplanned outage(s) of coal generators to 2038 present significant upside risk to prices and volatility.
- Pumped hydro and transmission upgrades: Delays to either will result in further upside risk to price.
- Weather: The influence of weather on demand, renewables resources, transmission transfer capacity amongst many other variables, can have both an upside and a downside risk to prices.
- Gas prices: The largest contributing factor to the marginal cost of gas generators, which often set the price during peak evening periods, varies the long-term price outcome significantly.

**Forecast generation and percentage of renewables vs government forecast**




Source: Rystad Energy research and analysis

# Challenges to meeting the 82% target – Project approvals have plummeted

Renewables developers are facing increasing durations and challenges getting projects approved by state departments of planning in New South Wales and Victoria.

**Approvals plummeting**

Australian renewable developers are facing their next big challenge with utility wind and solar project approvals plunging 75% in four years. A lack of project approvals adds another key hurdle for Australia's transition in addition to commissioning challenges, pumped hydro delays / cost overruns, supply chain issues, transmission project delays and a lack of storage being built.

**Why is this happening?**

In summary, project approvals are suffering because planning departments are:

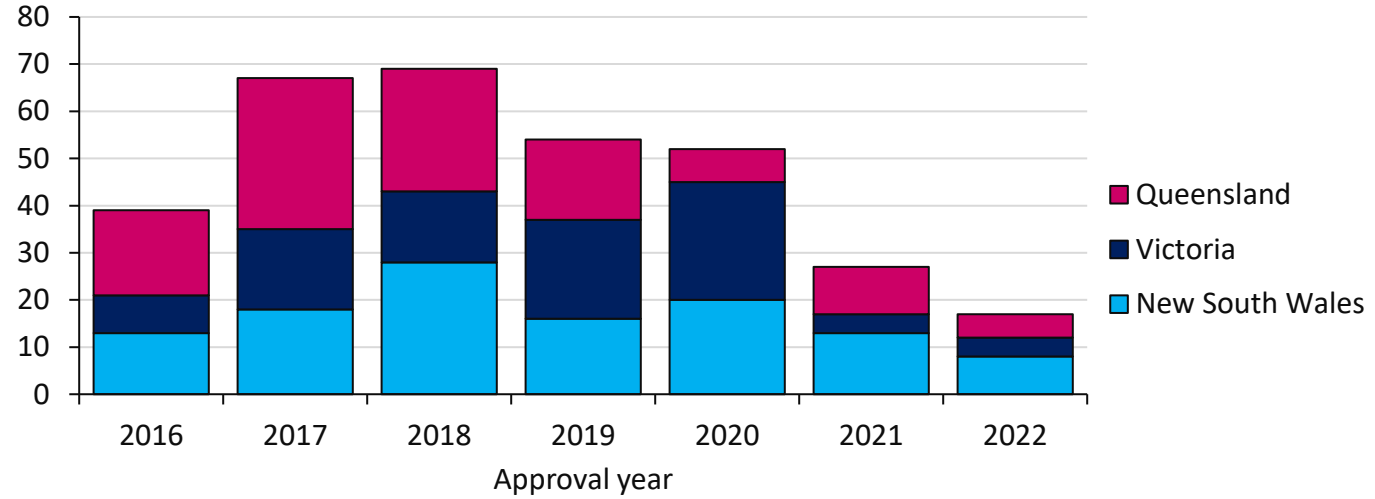
- Asking for too much information.
- Often cancelling necessary site visits.
- Rejecting the lodgment of development applications (DAs) to meet internal metrics
- Pushing developers to more complex sites and substantially increasing the cost of DAs.

**Why does it matter?**

The three eastern states of New South Wales, Victoria and Queensland need to start construction of 4 $GW_{AC}$ per year of utility wind and solar to 2050 to transition away from coal. However, project approvals in 2022 totaled just 2.2 $GW_{ac}$, well below the required amount.

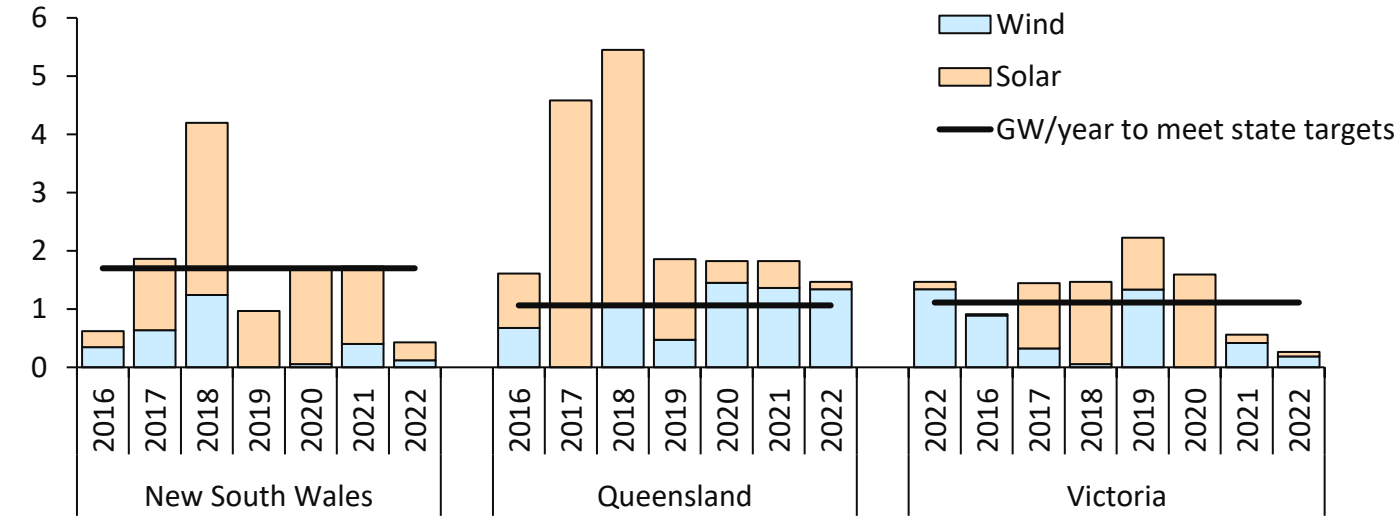
**Number of utility solar and wind projects approved by state**

Number of projects




**Annual capacity approved vs capacity required to meet 2030 state targets**

Gigawatts AC ($GW_{AC}$)




Source: Rystad Energy research and analysis

# Challenges to meeting the 82% target – Commissioning not keeping up with build out

**Commissioning constraints:**

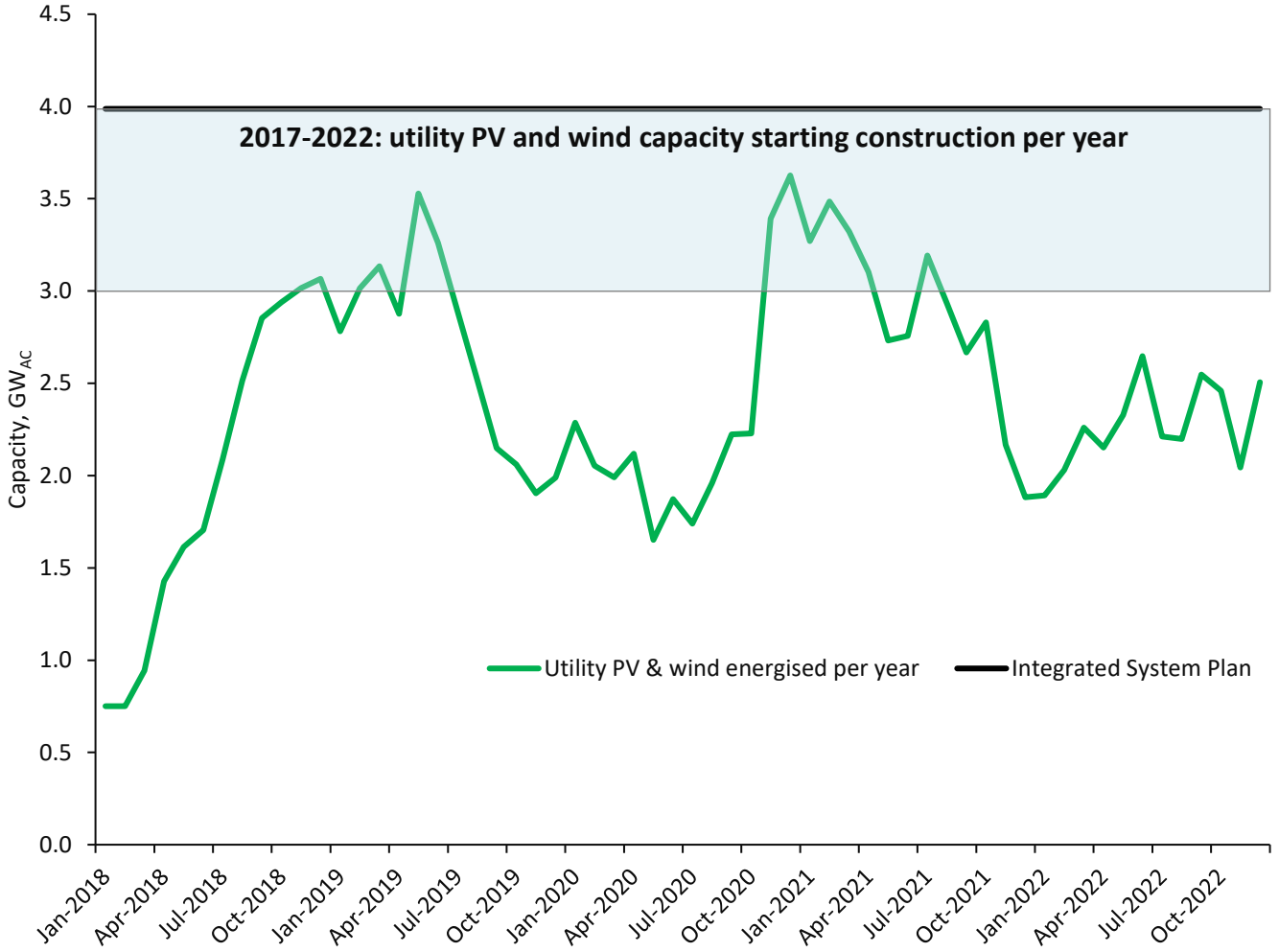
- Australia needs to commission 4 GW of utility PV and wind per year in the NEM to keep pace with its targets.
- However, the empirical evidence (see right) shows that while Australia is beginning construction on approximately 3-4 GW/year of utility PV and wind, it is rarely able to commission more than 3 GW/year, due to the technical challenges of commissioning adding such large amounts of renewables to the grid.
- Furthermore, there has been a recent trend towards larger-scale projects over 300 megawatts (MW) in size in recent years which have a greater impact on the local network and typically take over a year to commission from energization. By contrast, smaller projects (<200 MW) typically commission in under 200 days.
- Commissioning challenges will increase as more utility batteries get built and compete for commissioning services with utility solar and wind projects.

**Scale matters:**

- Utility solar and wind construction and commissioning durations are significantly longer with increased project size.
- Above 300 $MW_{AC}$ projects typically take at least 2-3 years to construct and commission.
  - See next slide
- Over 60% of the capacity starting construction in 2022 is greater than 200 $MW_{AC}$. Hence, these projects will be at more risk of both construction and commissioning delays.

**Utility PV and wind capacity energized per year vs starting construction**

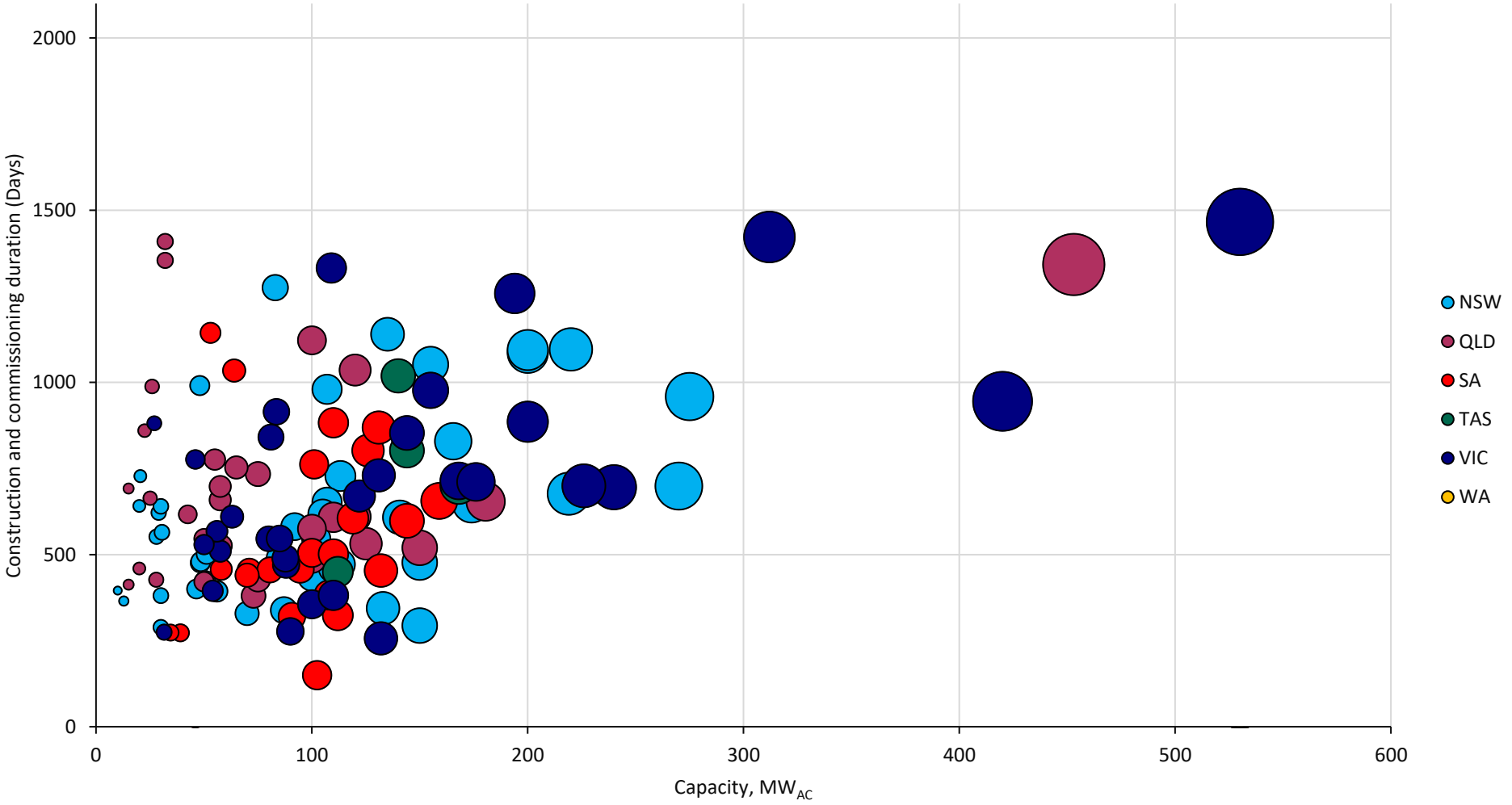
Gigawatts ($GW_{AC}$)




Source: Rystad Energy research and analysis

# Challenges to meeting the 82% target – Larger projects take several years to complete

**Utility solar and wind assets construction and commissioning duration by asset (bubble) and state (colour)**
Days




Source: Rystad Energy research and analysis

# Challenges to meeting the 82% target – Transmission capacity running out / REZ delays

**Transmission constraints:**

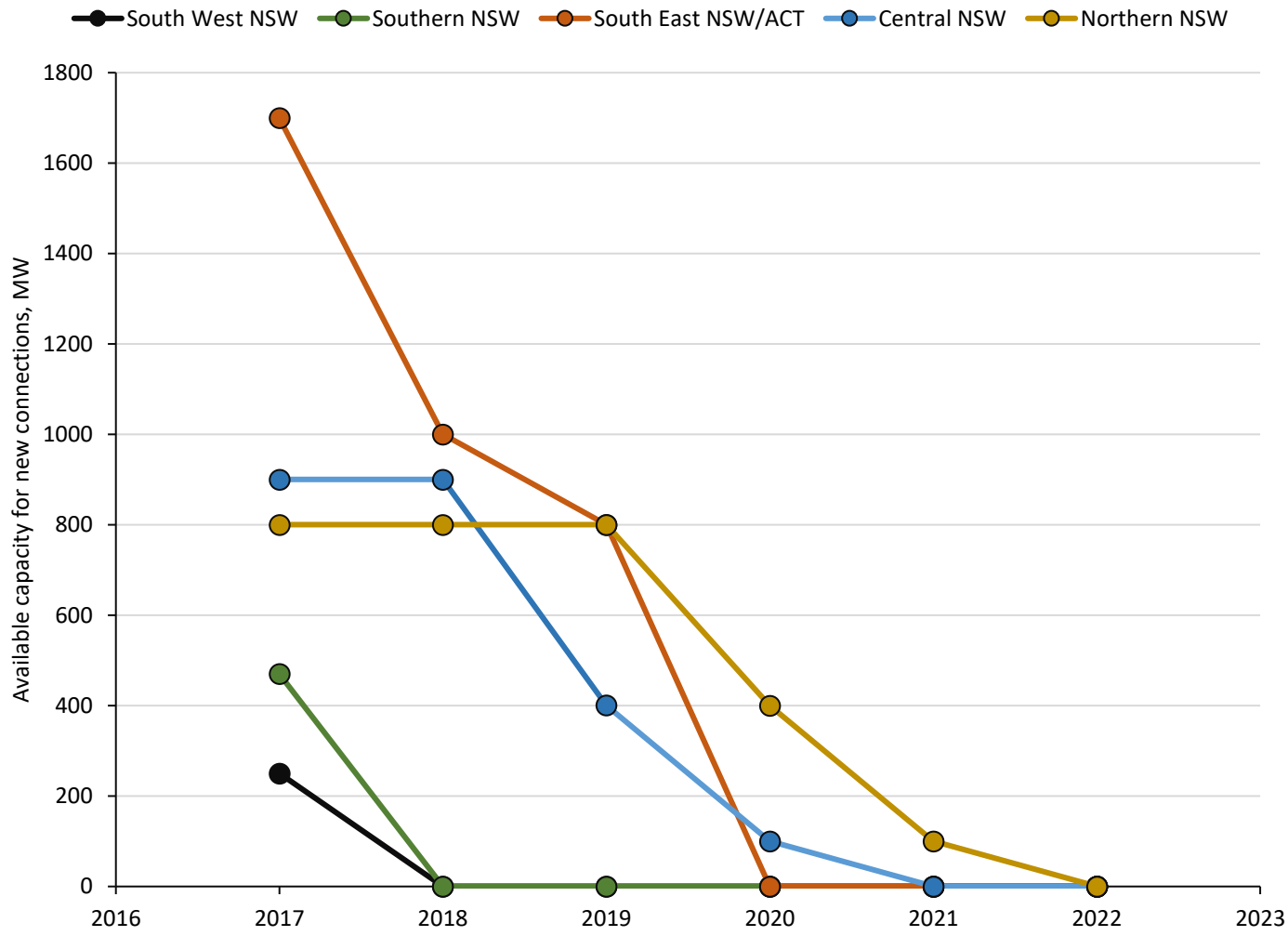
- Another hurdle is available capacity for new connections in the transmission system.
- Over the past five years, construction of solar and wind capacity in regional areas of Australia with good renewable resources has led to transmission lines becoming congested during peak renewables generation periods.
- To add sufficient renewables and storage to the grid to meet Australia's renewables goals, $A32 billion would need to be spent on transmission upgrades to 2035.
- The key risk with building transmission is gaining the social license for high voltage transmission towers over hundreds of kilometers from the renewables-rich areas of regional Australia to state capital cities by the coast.
- This is particularly relevant in NSW, where new transmission capacity is needed to continue the build out of utility PV and wind.

**REZ delays:**

- Furthermore, the build out of Renewable Energy Zones (REZ), which add new network capacity for new renewables are being delayed by several years. The most recent example are:
  - Central West Orana REZ: Delayed from 2025 to 2027.
  - New England REZ delayed from 2027 to 2029.

**Transgrid (NSW), available capacity for new connections**

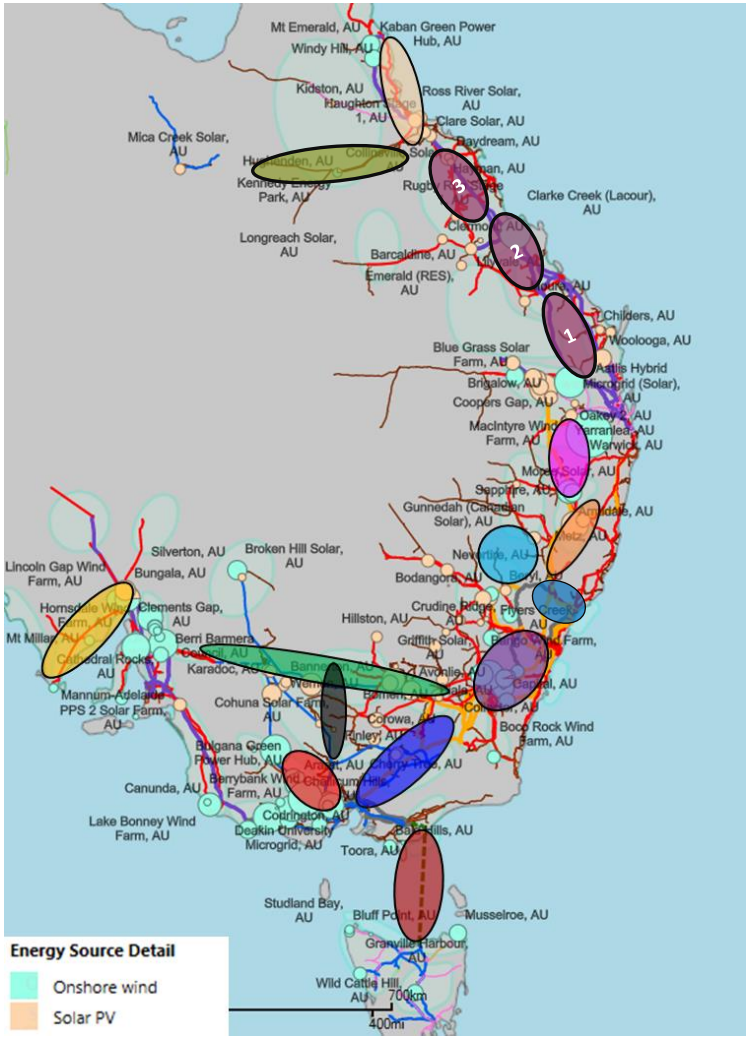
Megawatts ($MW_{AC}$)




Source: Rystad Energy research and analysis, Transgrid transmission annual planning reports

# Transmission upgrades to 2035

| Transmission project | Delivery | Capacity increase | Capex (AUD billion) |
|---|---|---|---|
| VNI Minor | 2022 | 170 MW | 0.1 |
| Eyre peninsula link | 2023 | 240 MW | 0.3 |
| QNI Minor | 2023 | 150-190 MW | 0.2 |
| NQ REZ Stage 1 | 2023 | 500 MW of new generation in NQ | 0.01 |
| Energy Connect | 2026 | 800 MW | 2.3 |
| West VIC | 2026 | 1500 MW | 0.4 |
| Humelink | 2026 | 2200 MW | 3.3 |
| Central West REZ (NSW) | 2027 | 4500 MW | 3.2 |
| Hunter REZ | 2027 | 950 MW | 0.43 |
| New England REZ | 2029 | 6000 MW | 4.2 |
| Marinus link phase 1 | 2029 | 750 MW | 2.4 |
| Marinus link phase 2 | 2031 | 750 MW | 1.4 |
| VNI West | 2031 | ~1850 MW | 3.3 |
| QEJP Stage 1 | 2029 | >3000 MW | 0.8 |
| QEJP Stage 2 | 2031 | >3000 MW | 1.3 |
| QEJP Stage 3 | 2033 | >3000 MW | 3.4 |
| Copper String * | 2028** | >3000 MW | 5.0 |




*Prior to Copper String announcement this was QEJP Stage 4 (delivery 2035, capex A$1.7 billion). **Estimated delivery date.
Source: Rystad Energy research and analysis

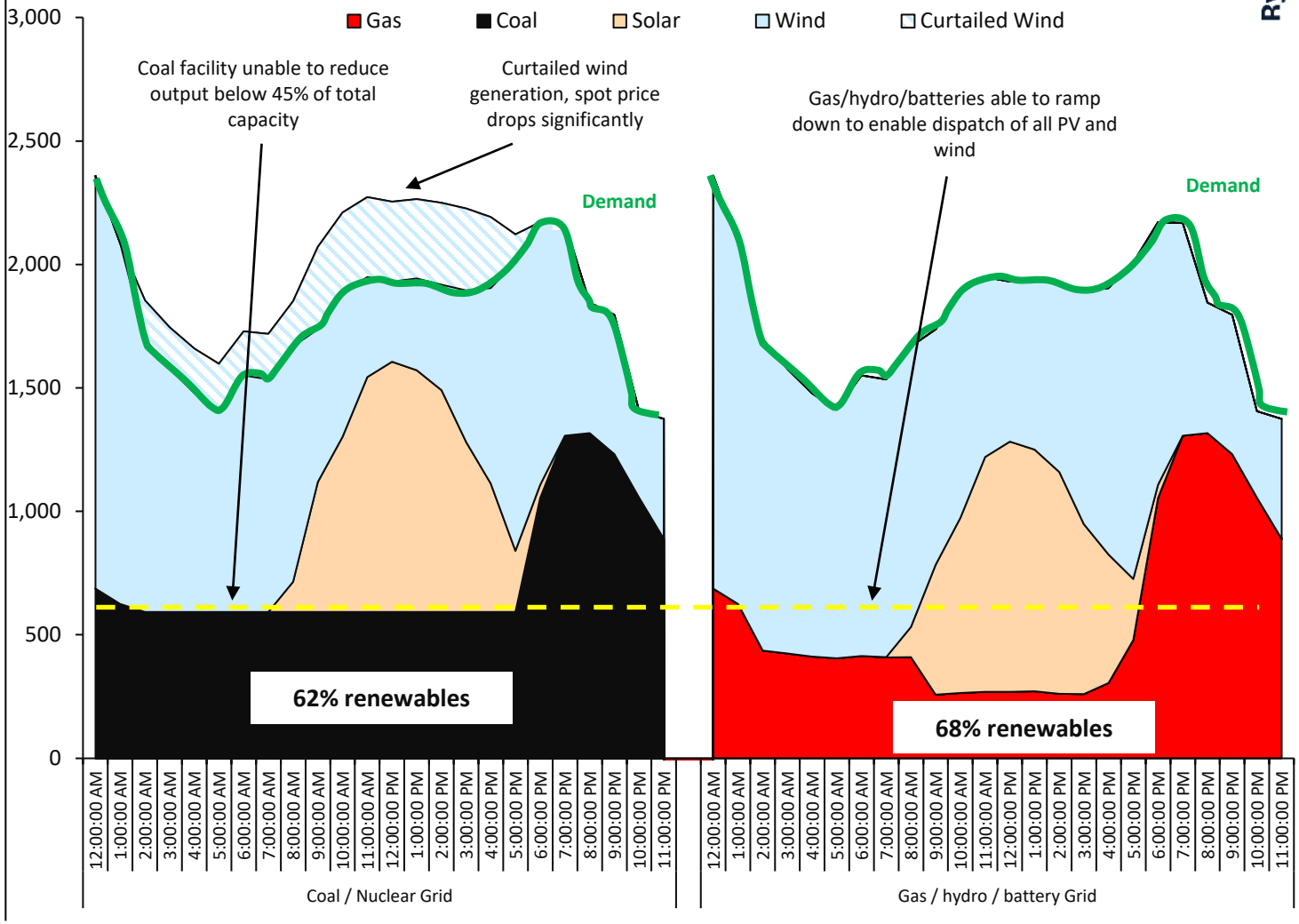
# Challenges to meeting the 82% target – Non complimentary dispatchable capacity

**The dispatchable capacity mix does not optimally compliment PV & wind:**

- In Australia's NEM, the bulk of non-renewables generation is from black and brown coal.
- These facilities have a high minimum turndown capacity (40-60% of maximum capacity) and result in more renewables curtailment than more flexible gas, hydro and battery facilities which can ramp down to very low levels during periods of high renewable generation.
- The figure to the right gives an example of this impact, whereby both grids have the same demand, solar and wind generation available but the grid on the left is firmed by less flexible coal and the right by more flexible gas. The results show the impact of flexibility is a 6% increase in renewables generation for the grid with flexible dispatchable capacity, a concept examined in more detail in a previous commentary.

**Comparison of non-flexible/flexible dispatchable renewable generation capacity**

Megawatts (MW)




Source: Rystad Energy research and analysis

# Challenges to meeting the 82% target – Storage needed ASAP to soak up solar & wind

**Lack of storage capacity relative to solar PV/wind:**

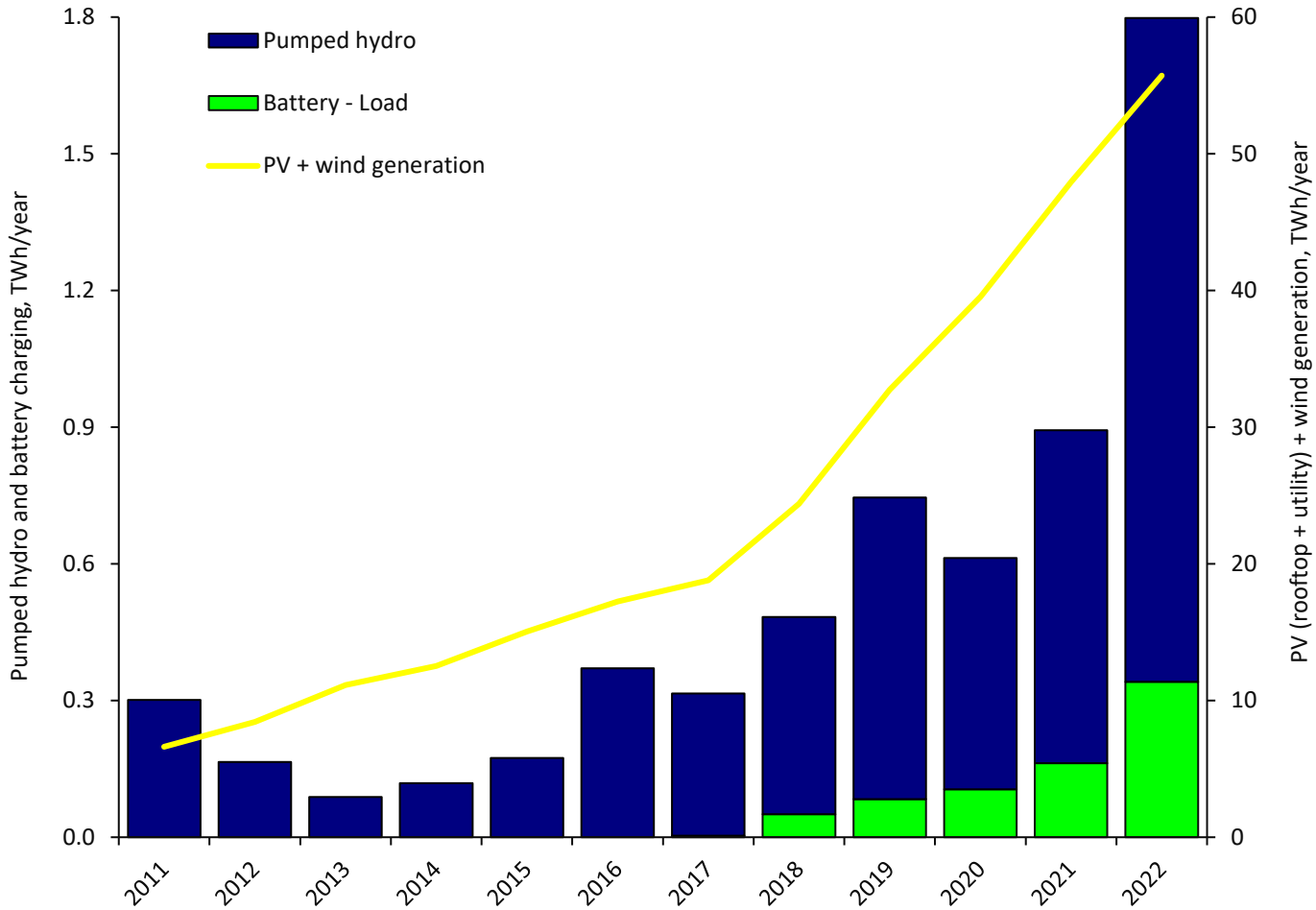
- Another constraint limiting Australia's penetration of solar and wind generation is the lack of storage capacity that can store excess solar and wind generation for later use.
- As of April 2023, the NEM has 32 $GW_{AC}$ of operational solar PV (rooftop PV + utility) and wind.
- By comparison, just 2.5 $GW_{AC}$ of utility batteries and pumped hydro capacity is operational.
- Furthermore, the 1.2 $GW_{AC}$ of utility batteries are most often used for frequency control ancillary services (FCAS) and less for shifting energy (energy arbitrage).

**Large independent power producers / gentailers need to build the batteries**

- Economic analysis performed by Rystad Energy has highlighted that standalone utility battery economics do not justify their deployment.
- Only a few large scale (>150 $MW_{AC}$) utility batteries have been deployed without subsidy.
- The owners of these batteries include AGL (Torrens Island), Origin (Eraring) and Shell / Macquarie (Rangebank).
- Hence gentailers and large independent power producers will be critical for accelerating the deployment of batteries.

**NEM battery & pumped hydro charging vs solar PV & wind generation**

Terawatt-hours (TWh) per year




Source: Rystad Energy research and analysis

# Projects and capacity reaching financial close

Rystad Energy provides an independent forecast of the utility solar, wind and batteries. The three key pillars we consider when assessing the likelihood of an asset getting constructed in the short to medium term are:

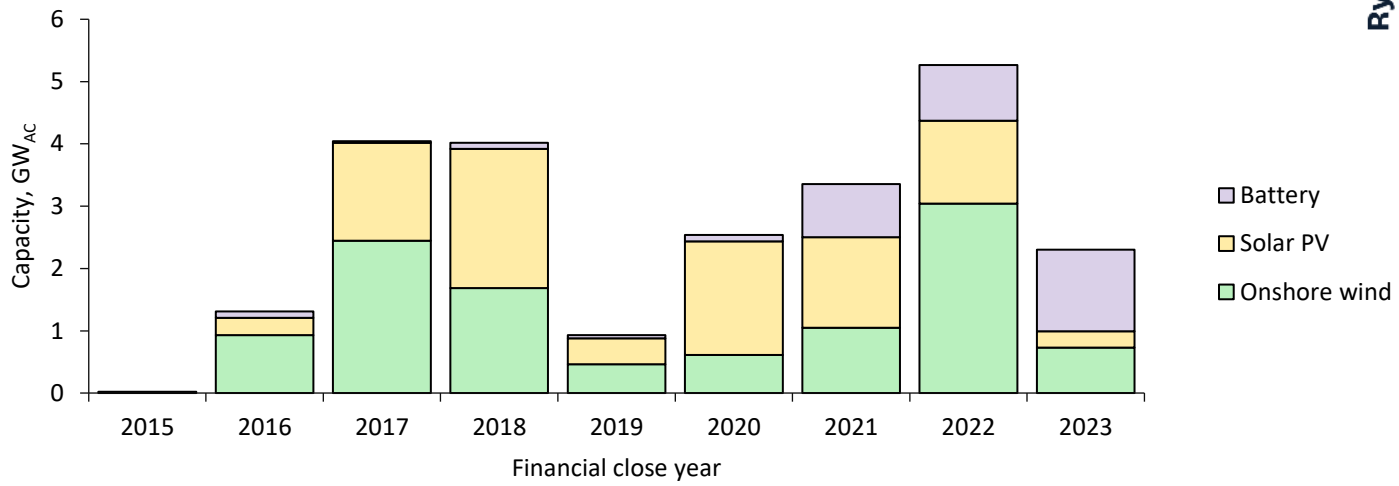
- Land & approvals: This includes all approvals associated with a development application.
- Transmission: This is a function of the asset's location in the grid and how much network capacity is available.
- Certainty of revenue: Either from a corporate / utility Power Purchase Agreement, government auction or other mechanism. This is crucial for most companies to secure debt to build their project.

**Negative on all three**

- Land & approvals: Project approvals are plummeting due to local planning constraints. See slide title *"Project approvals have plummeted"*
- Transmission: Declining rapidly in all areas of development, but particularly New South Wales. See slide *"Transmission capacity running out / REZ delays"*
- Certainty of revenue: Infrequent auctions from state government, except for New South Wales (bi-annual tenders).

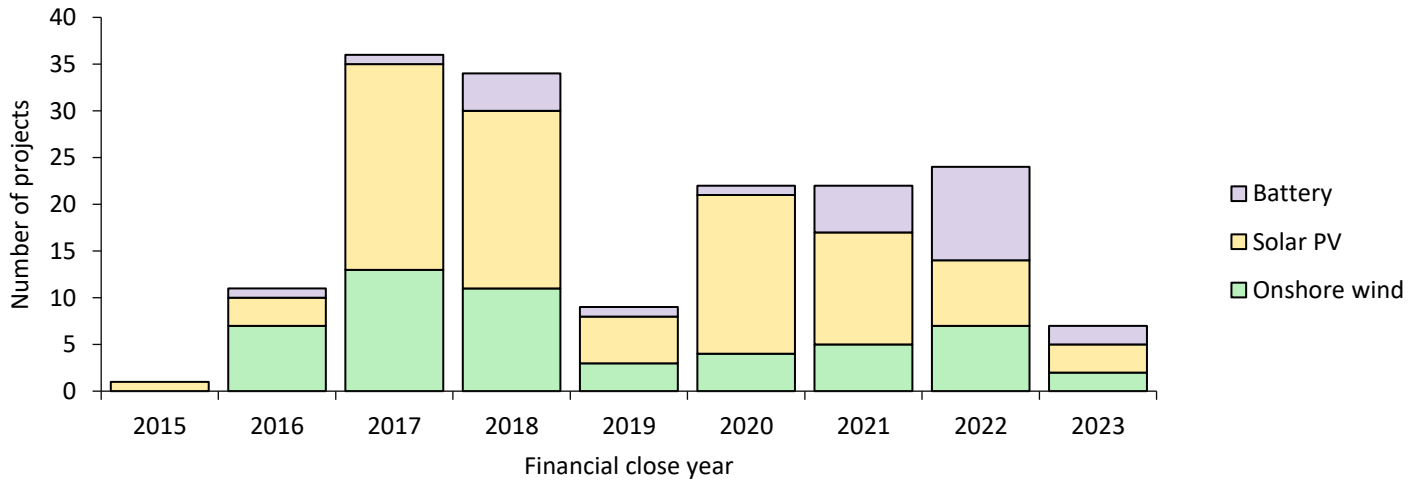
**NEM utility PV, batteries and wind by financial close year (>20 $MW_{AC}$)**

Gigawatts AC ($GW_{AC}$)




**NEM utility PV, batteries and wind by financial close year (projects >20 $MW_{AC}$)**

Number of projects




Source: Rystad Energy research and analysis

# Gentailers have large role to play in building or contracting solar, wind and storage

Re-assessing our criteria mentioned on the (previous slide & below) for a utility renewables or storage project to successfully reach Financial Close, there is a larger role to play for integrated generation/retailers (Gentailers):

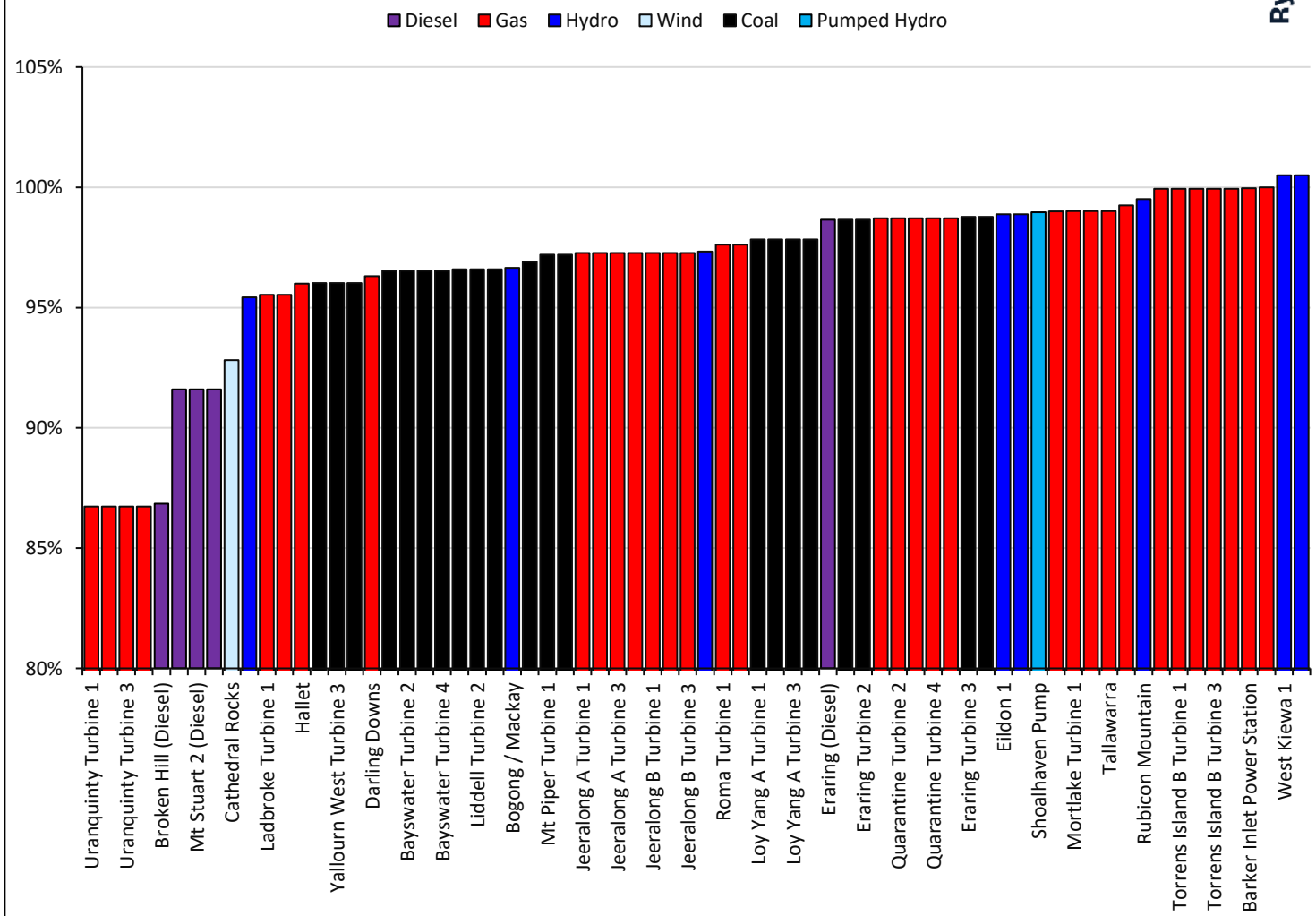
- Land & approvals
- Transmission
- Certainty of revenue

**Gentailers advantages**

- Land & approvals: Through their existing fleet of assets, gentailers already have access to land utilized for power generation.
- Transmission: The connection points of the assets owned by the three largest gentailers are in favorable spots in the grid reflected by the company's high marginal loss factor (MLF) across their portfolios (See right). For context the median MLF for a solar farm is 93% and 96% for wind. These locations, particularly the coal generators provide high capacity points of connection for replacement capacity as the coal facilities retire. This is a critical advantage, given the lack of network space available in the regional areas of the grid.
- Certainty of revenue: A distinct advantage of being a gentailer is the access to debt to finance a project and / or the ability to offer an offtake agreement against the retail (demand) side of the business to provide certainty of revenue to build new renewable or storage projects. This distinct advantage, will mean Gentailers will have a very significant impact on the pace of utility solar, wind and storage build out.

**Financial year 22/23 marginal loss factors of assets owned by AGL, Origin and Energy Australia**

Percent (%)




Source: Rystad Energy research and analysis

# Pipeline of projects - The pipeline is not the issue

**The pipeline of utility solar, wind and storage**

Rystad Energy independently tracks all utility scale* solar, wind, storage and hydrogen electrolyser assets globally. The total pipeline of projects for the Australia market are presented below (as at August 2023). The annual additions are presented on the following slide.

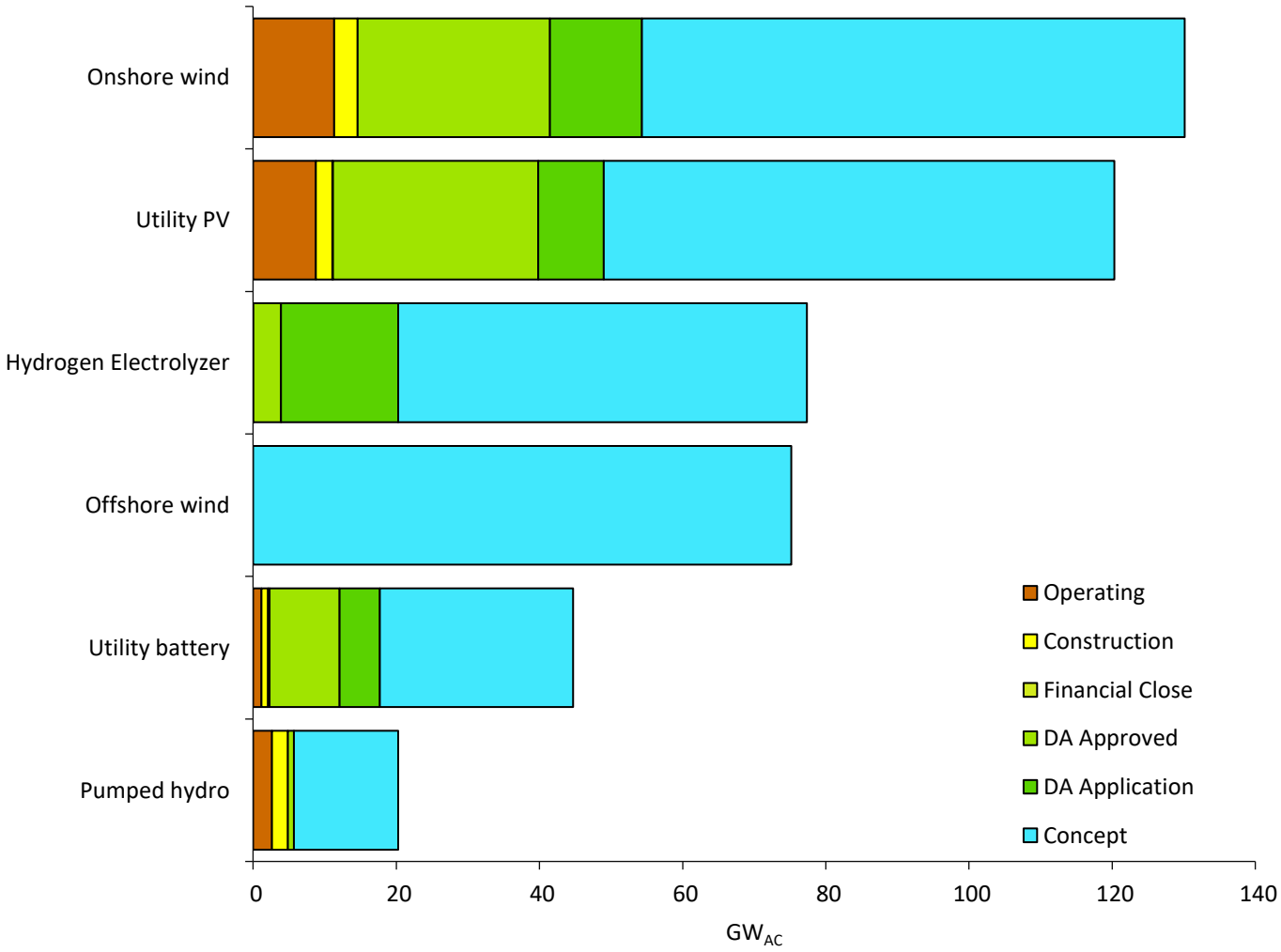
- Capacity: 495 $GW_{AC}$
- Number of 1503 Assets
- Number of companies: 428

The purpose of which is to highlight that there are no lack of projects or companies looking to invest in the Australia market. The challenge is getting projects to financial close, which are mainly centred around the three key pillars of development:

- Land & approvals: This includes all approvals associated with a development application.
- Transmission: This is a function of the asset's location in the grid and how much network capacity is available.
- Certainty of revenue: Either from a corporate / utility Power Purchase Agreement, government auction or other mechanism. This is crucial for most companies to secure debt to build their project.

**Australia utility PV, wind, storage and $H_2$ pipeline (11/07/2023)**

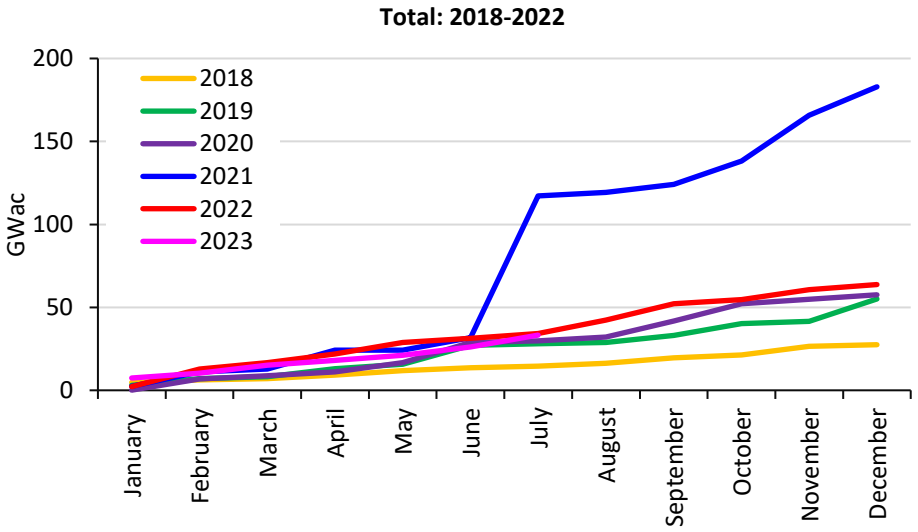
Gigawatts AC ($GW_{AC}$)

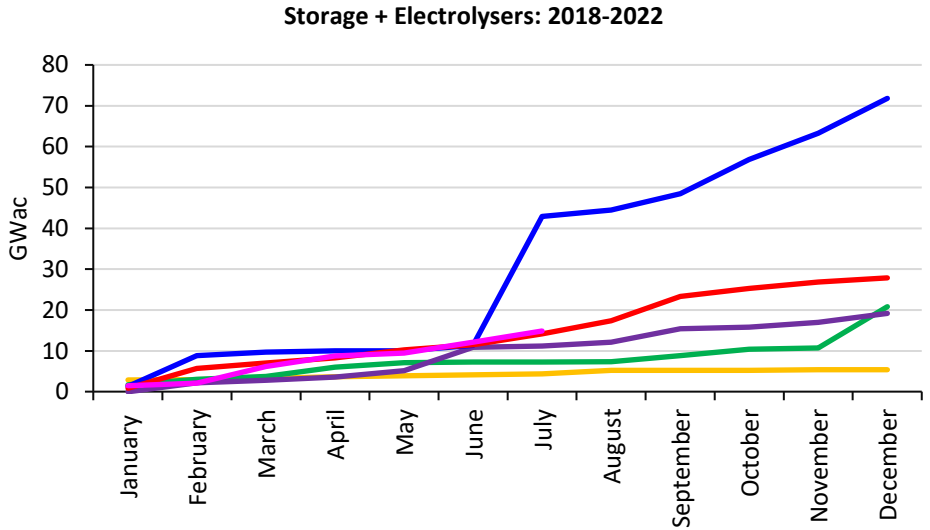


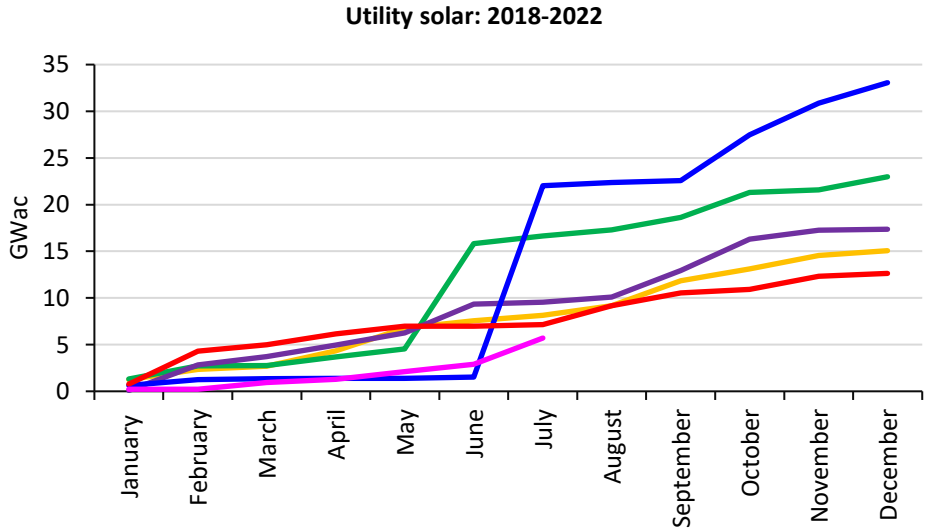

Source: Rystad Energy research and analysis

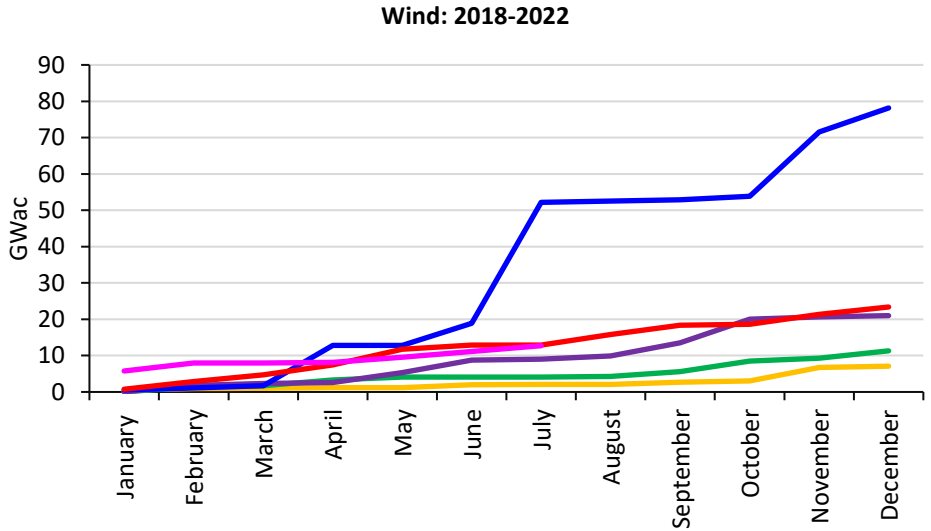
*>1 $MW_{AC}$ & excluding behind the meter solar and storage)

# Pipeline of projects – Annual capacity additions for Australia by technology




Source: Rystad Energy research and analysis

# Power Purchase Agreements critical for renewables deployment

Rystad Energy provides an independent forecast of the utility solar, wind and batteries capacity to start construction. The three key pillars we consider when assessing the likelihood of an asset getting constructed in the short to medium term are:

- Land & approvals: This includes all approvals associated with a development application.
- Transmission: This is a function of the asset's location in the grid and how much network capacity is available.
- Certainty of revenue: This is crucial for most companies to secure debt to build their project.

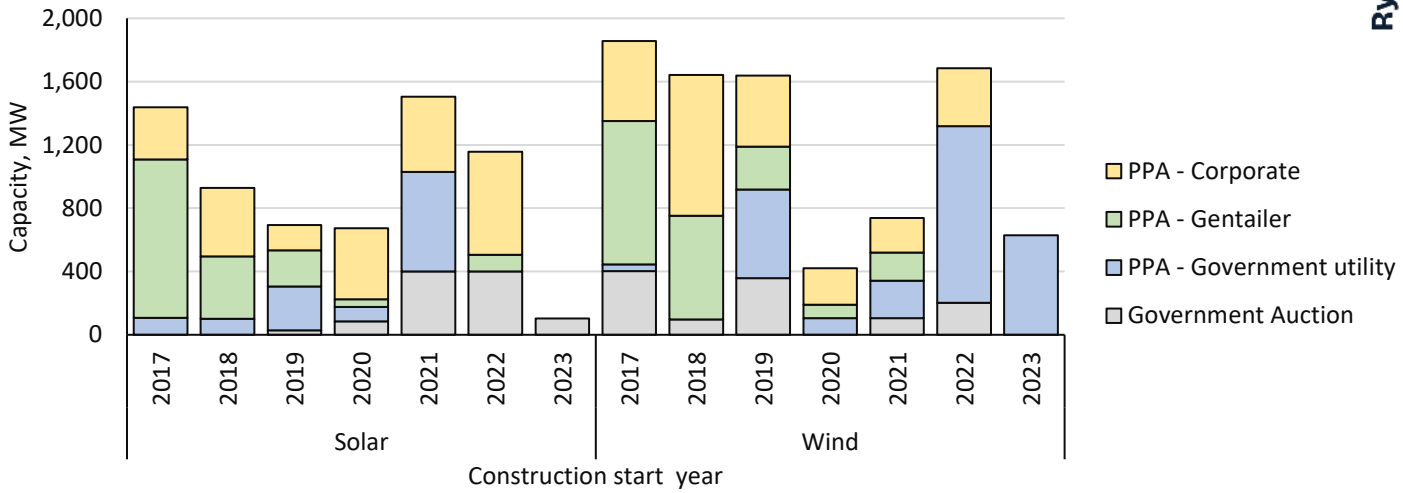
**Criticality of PPAs**

Power Purchase Agreements (PPA) are typically the source of certainty of revenue for utility solar and wind projects.

Rystad has analyzed the data for 26 GW of utility solar and wind assets operating and under construction. The data shows that 72% of asset capacity is contracted, highlighting the criticality of PPAs to instigate development of utility solar and wind.

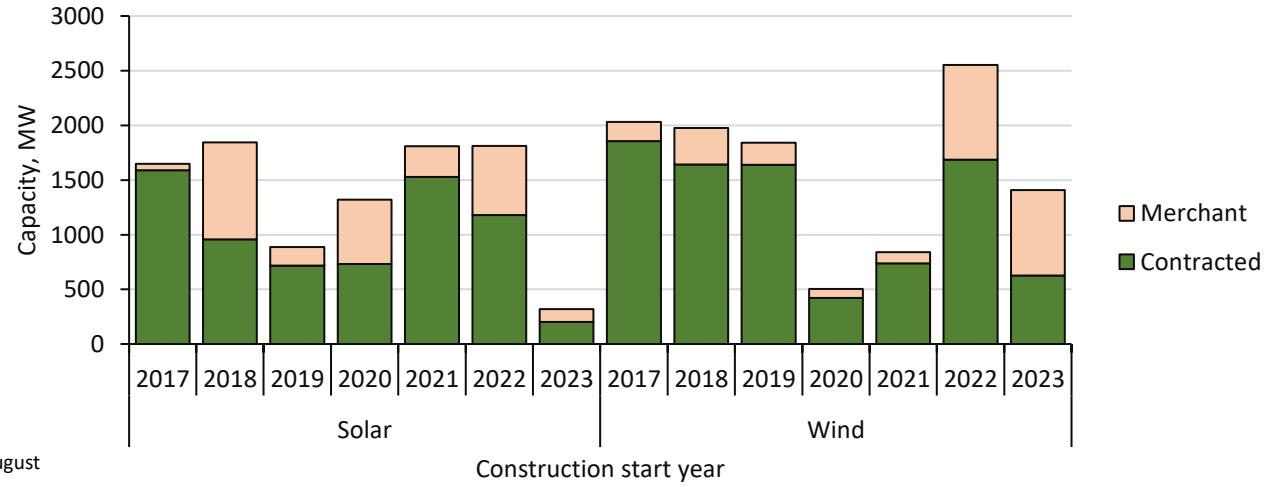
**Capacity contracted by asset construction start year (2017-2023*)**

Megawatts (MW)




**Utility solar and wind capacity contracted vs merchant (2017-2023*)**

Megawatts (MW)




Source: Rystad Energy research and analysis, *2023 data is to August

# Current Power Purchase Agreement volumes not enough to meet 2030 target

The contracted capacity data is presented on this slide by the year in which the PPA or government contract was awarded, rather than when the asset started construction.

**A brief history of events**

- 2017: A break out year for utility solar and wind contracting / construction start. Key drivers were high wholesale energy prices in the NEM, high LGC prices & significant reductions in PV capital expenditure per watt.
- 2018-2019: The utility solar and wind industry faced multiple issues denting investor confidence. These issues included but were not limited to
  - Construction and commissioning risk, most notably the largest solar EPC at the time RCR Tomlinson going bankrupt due to solar cost overruns.
  - Natural disasters - floods, cyclonic winds and bush fires.
  - Marginal Loss Factor reductions significantly reducing asset revenues.
- 2020: Despite the impact of COVID several corporate / government utility PPAs were signed. This was likely due to very low prices of PPAs available.
- 2021: Inflation started to push up the cost of both utility wind and solar.
- 2022-2023: Government auctions have underpinned recent contracting capacity, most notably the Victorian Renewable Energy Target (VRET) auction 2 and the NSW Long Term Energy Service Agreements (LTESAs).

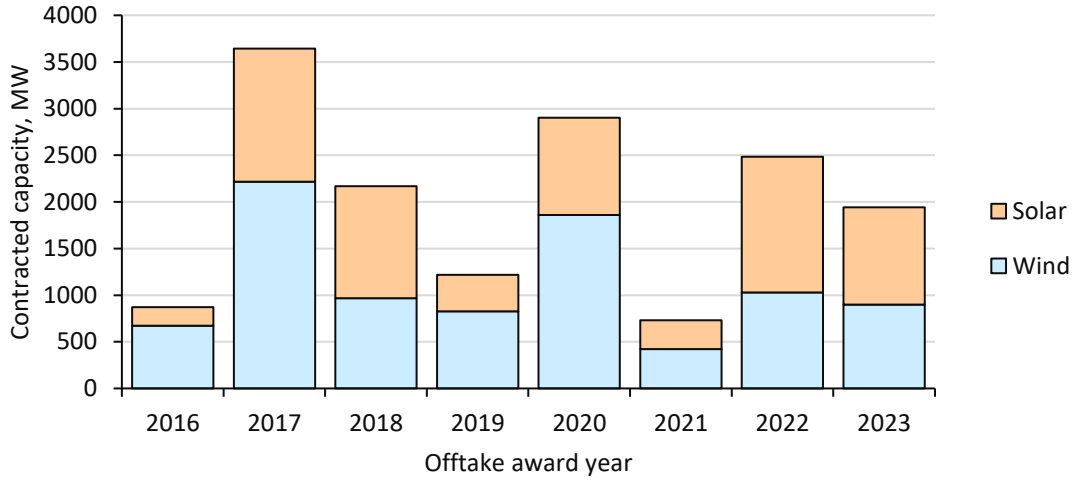
**Volumes contracted below target**

Rystad energy estimates that at least 4000 $MW_{AC}$ of utility solar and wind needs to start construction per year to 2030 to meet the governments 82% renewables target, by 2030. Assuming 70% of an asset's capacity needs to be contracted to get debt, this would mean 2800 $MW_{AC}$ needs to be contracted per year. However, the recent evidence (2021 to 2023) highlights this level of contracting is not being met.

Hence there is a clear role for Gentailers, corporates and government to all contribute to providing offtake agreements for renewables developers to secure debt and get solar and wind projects to financial close.

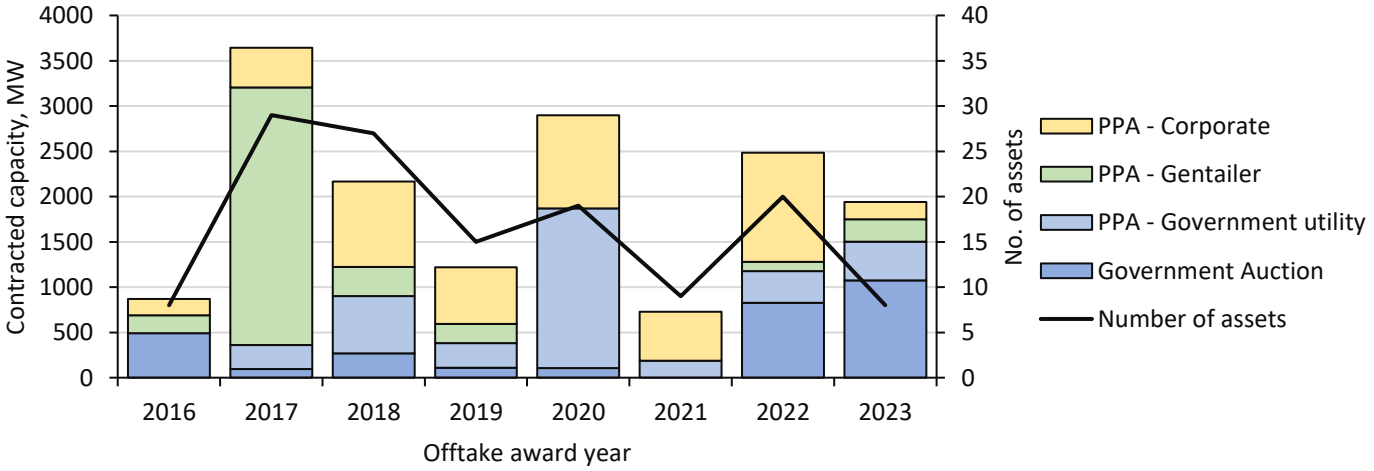
## Utility solar and wind capacity contracted by year of offtake award

Megawatts (MW)




## Utility solar and wind capacity contracted by year of announcement

Megawatts (MW)




Source: Rystad Energy research and analysis

# Gentailers typically sign PPAs prior to construction incentivizing investment

**When PPAs are signed matters**
Whilst the volumes contracted by the four different mechanisms is approximately similar, the timing of when these contracts were awarded matters.

Long term offtake agreements signed prior to financial close, help the developer secure debt to get the project to construction. Whilst offtake agreements signed after construction start do not determine whether an asset will reach operation, but merely impact the cash flows.

Rystad Energy reviewed 203 utility solar and wind assets and compared their construction start date with the announcement date of the relevant offtake agreement to determine if the offtake was awarded pre or post construction.

Gentailers have contracted the most capacity preconstruction compared to corporates or government owned utilities, thus have had the greatest direct impact in providing certainty of revenue to assist utility solar and wind development in Australia.

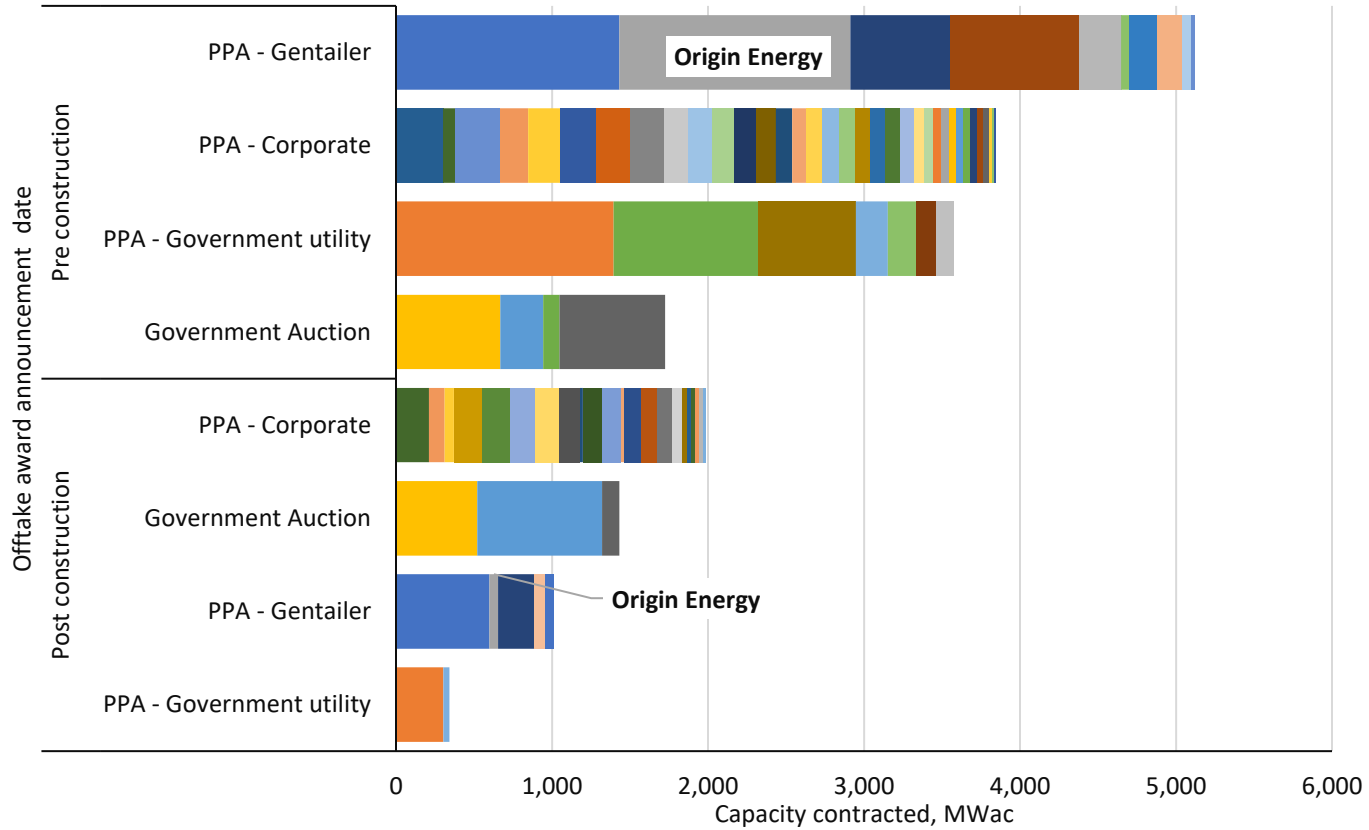
**Significant targets to make a meaningful contribution to accelerate the transition**
Several of the Gentailers have significant medium-term targets, including

- AGL: 5 GW of new renewables and firming capacity in place by 2030 , ~12 GW of additional renewable and firming capacity before 2036.
- Origin Energy : 14 GW by 2033 (Brookfield green build out plan)
- EnergyAustralia: Expand their renewable portfolio to include up to 3 GW by 2030.
- Alinta Energy: Development of 1,500MW of renewable generation and storage capacity by FY25.

The following graph represents the amount of capacity contracted from utility solar and wind projects. The data is broken down into four different offtake types, three of which are Power Purchase Agreements (PPAs) distinguished by the offtaker themselves (Gentailer, Corporate & Government utility), the other offtake type is Government Auctions (E.g. VRET auctions, ACT reverse auctions).

The data is further split between offtake award announcement date and if it was prior to construction (i.e. helping to incentivize new investment) or after construction start of the new project (thus not contributing to new investment).

Each colour represents the company (e.g. Origin Energy) or government body that is the offtaker.




Source: Rystad Energy research and analysis

# 26 GW of renewables + storage needed for gentailers to hit targets

**AGL:**
- Target: 5 GW of new renewables and firming capacity in place by 2030 , ~12 GW of additional renewable and firming capacity before 2036.
- Capacity still needed to 2036: ~10 GW
- Annual rate: ~0.8 GW/year

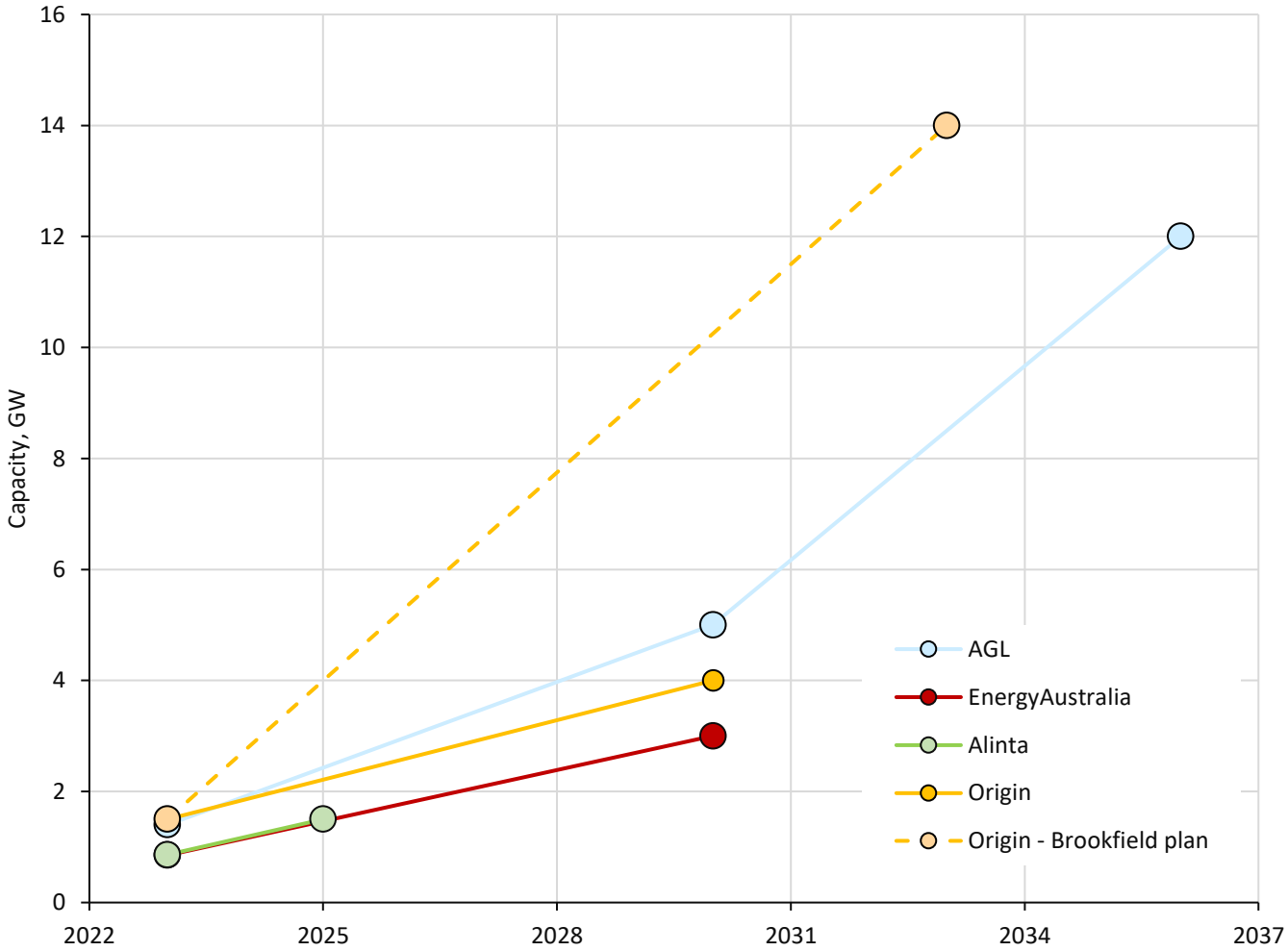
**Origin Energy:**
- Target: 4 GW by 2030
- Capacity still needed to 2030: ~2.5 GW
- Annual rate: ~0.4 GW/year

**Origin Energy (Brookfield green build out plan):**
- Target: 14 GW by 2033 (Brookfield green build out plan)
- Capacity still needed to 2033: ~12.5 GW
- Annual rate: ~1.3 GW/year

**EnergyAustralia:**
- Target: Expand their renewable portfolio to include up to 3 GW by 2030.
- Capacity still needed to 2030: ~2.2 GW
- Annual rate: ~0.3 GW/year

**Alinta Energy:**
- Target: Development of 1,500MW of renewable generation and storage capacity by FY25.
- Capacity still needed to 2025: ~0.6 GW
- Annual rate: ~0.3 GW/year

**Gentailer renewables capacity developed + contracted vs targets**
Gigawatts (GW)




Source: Rystad Energy research and analysis

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RystadEnergy

Navigating the future of energy

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Headquarters: Rystad Energy, Fjordalléen 16, 0250 Oslo, Norway
Americas +1 (281)-231-2600
EMEA +47 908 87 700
Asia Pacific +65 690 93 715
Email: support@rystadenergy.com

Allens
Deutsche Bank Place
Corner Hunter and Phillip Streets
Sydney NSW 2000 Australia

T +61 2 9230 4000
F +61 2 9230 5333
www.allens.com.au

GPO Box 50
Sydney NSW 2001 Australia

ABN 47 702 595 758

**Public Version**

Allens › ‹ Linklaters

24 August 2023

Mr David Dixon
Senior Analyst, Renewables Research
Rystad Energy
Level 22, Salesforce Tower, 180 George Street
Sydney, NSW 2000, Australia

**By Email:** [redacted]

**Private & Confidential**

Dear Mr Dixon

## Letter of Instructions: Project Eos

1 We refer to our engagement letter to you dated 23 August 2023. Terms defined in that letter have the same meaning in this letter.

2 This letter sets out instructions to be taken into account as part of your engagement to prepare an initial report.

3 Please continue to comply with all obligations set out in our 23 August 2023 letter, including the obligations set out in the Federal Court's Expert Evidence Practice Note provided to you with that letter.

### Proposed Transaction

4 A consortium comprising Brookfield and MidOcean Energy (the ***Scheme Consortium***) has offered to acquire all of the shares in Origin Energy Limited (***Origin***) by way of a scheme of arrangement.

5 Immediately following the implementation of the Scheme, the Origin business will be separated as follows:

(a) Origin's Energy Markets business (***Origin Energy Markets***) will be acquired by subsidiaries of a limited partnership Eos Aggregator (Bermuda) LP (the ***Brookfield LP***), the investors in which will be Brookfield Global Transition Fund I (***BGTF***) and Brookfield Renewable Partners L.P (***BEP***) with an interest of approximately [redacted] - 67%, with co-underwriters including subsidiaries of Temasek (9.9%) and GIC (22.5%).

(b) Origin Energy Markets comprises Origin's energy retailing business, electricity generating assets, energy wholesale and trading business, development assets relating to energy production and storage, its investment in Octopus Energy and its LPG business and domestic gas trading business.

(c) Origin's Integrated Gas business (including its upstream gas interests and shareholding in APLNG) will be retained by MidOcean Energy.

6 This is referred to in this letter as the ***Proposed Transaction***. On 5 June 2023, the Scheme Consortium applied for merger authorisation in connection with the Proposed Transaction

(***Application***). On 16 August 2023, the ACCC requested additional information from the Applicants pursuant to s 90(6)(b) of the *Competition and Consumer Act 2010* (Cth) (***ACCC Information Request***), a copy of which is set out at **Schedule 1** to this letter.

## Instructions

7 Based on your training, study and experience, you are requested to provide your opinion in writing (and the reasons for it) on question 1 of the ACCC Information Request, insofar as it relates to the likelihood that Australia will meet its goal of 82% renewable generation for the NEM by 2030. We understand that Rystad does not have expertise to comment on the emissions target aspect of the question.

8 Please let us know whether you have any queries about the questions above or the engagement more generally.

Yours sincerely

[redacted]

**Fiona Crosbie**
Chair
Allens
[redacted]
T +61 [redacted]

**Ted Hill**
Partner
Allens
[redacted]
T +61 [redacted]

**Felicity McMahon**
Partner
Allens
[redacted]
T +61 [redacted]

**Schedule 1 – ACCC Information Request**

# Batteries a key mid-term solution for decarbonizing Australia's NEM

*24 May 2023 - O&G Sustainability Analytics*

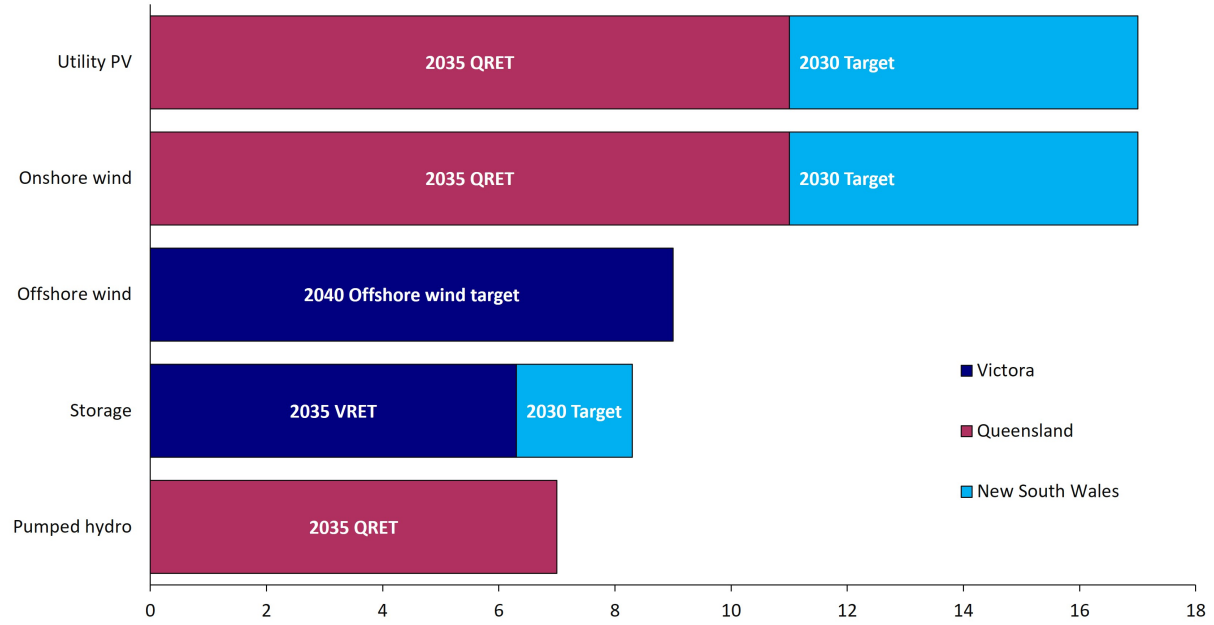
Australia's target to achieve 82% renewables by 2030 in the eastern region's interconnected National Electricity Market (NEM) is unlikely to be reached unless steps are taken to boost battery storage capacity and address a range of network challenges. Instead, Rystad Energy forecasts that just 64% renewables will be achieved by the end of this decade under a business as usual (BAU) approach. The hindering factors include insufficient commissioning of the required 4 GW/year of utility solar PV and wind, declining transmission capacity and risk of delayed upgrades, a lack of storage to shift energy and decongest the existing network, and the fact that the current dispatchable capacity mix to compliment wind/PV is mostly coal-based. In this commentary, we propose four potential solutions to lift the share of renewables by 2030, assuming transmission upgrades cannot be accelerated. These include replacing coal generation with gas plant, using utility scale batteries to boost transmission in the existing network, shifting subsidies from rooftop solar to batteries, and contracting wind plant offshore New South Wales (NSW). Of these, the most favorable is boosting the use of utility batteries and shifting subsidies from rooftop solar to behind-the-meter (BTM) storage. This would enable renewables to grow its market share by an extra 3-4% (68% vs 64%). While this would see Australia still fall short of its 2030 target, it would at least lift renewables penetration further than is currently possible.

**NEM's 82% by 2030 target driven by state & federal plans**

Australia's 82% renewables by 2030 target for the NEM is outlined in the Powering Australia plan which was introduced by the federal Labor government last year and is supported by policies at a state and federal level. It excludes South Australia, Tasmania and Western Australia and any rooftop PV/BTM storage and large-scale facilities already in construction. To achieve the target by 2030, between 3.5 and 4 GW of new utility PV, wind and storage would need to start construction annually. In our view, the most significant element of federal-level support is the A$20 billion (US$13 billion) allocated to transmission upgrades via low-cost financing through the Clean Energy Finance Corporation (CEFC). To date, a combined A$12 billion has been allocated to the Marinus Link, the Victoria New South Wales Interconnector (VNI) West, as well as to renewable energy zones (REZ) in Victoria and NSW. At a state level, the largest electricity markets of NSW, Queensland and Victoria all have medium-term targets for new renewable energy supply and associated storage. In Queensland, 22 gigawatts (GW) of new utility PV and wind will be constructed through to 2035, along with 7 GW of pumped hydro and transmission upgrades from south to north (500 kilovolt/kV network). In Victoria, 6.3 GW of storage will be installed by 2035 and 9 GW of offshore wind by 2040, with the state also benefitting from several intra-state/interstate transmission upgrades (Figure 3b). In NSW, 12 GW of utility PV/wind and 2 GW of storage will be constructed by 2030, replacing 6 GW of exiting coal-fired generation capacity.

**Figure 1: Targets for renewables, pumped hydro and storage in the NEM to 2040**

Gigawatts (GW)

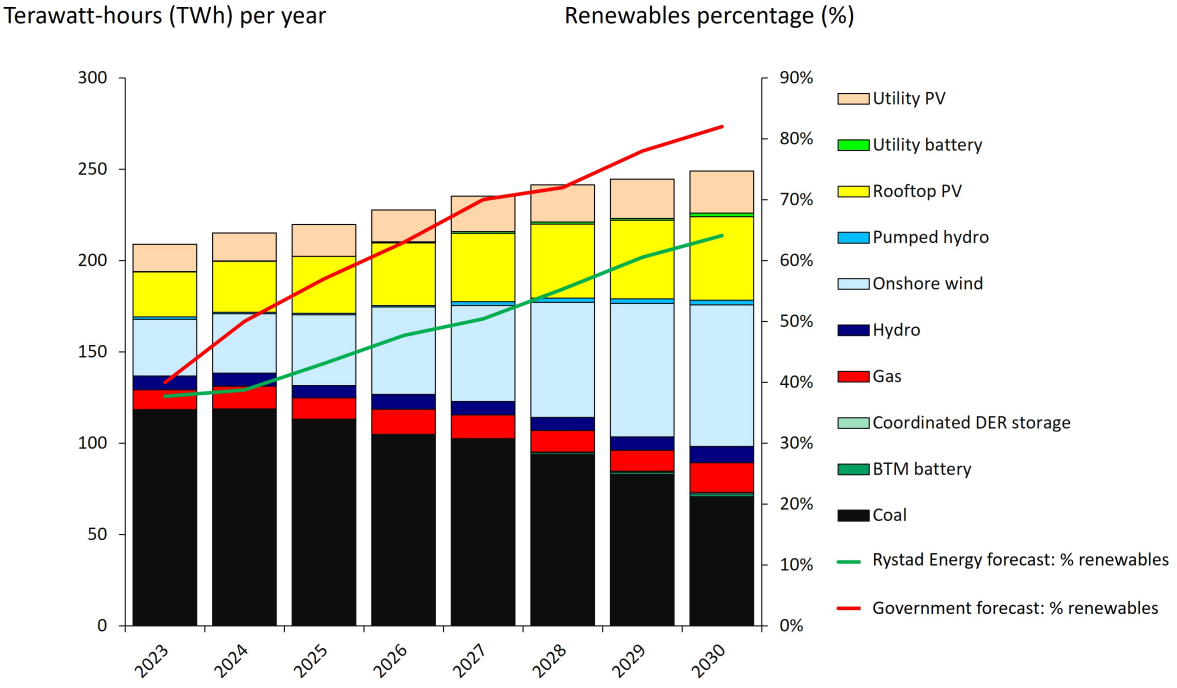



QRET: Queensland Renewable Energy Target. VRET: Victoria Renewable Energy Target
Source: Rystad Energy research and analysis

David Dixon
Rystad Energy

**Australia to fall short of target by 18%**
Rystad Energy's power mix forecasting has determined that the NEM will achieve 64% renewables by 2030 based on current federal and state funding allocations. Whilst this represents a significant increase on the 35% renewables achieved in 2022, it falls 18% short of the federal government's Powering Australia target of 82%. We discuss the reasons for this below which include commissioning and transmission constraints, the fact that the dispatchable capacity mix is not ideal to compliment PV & wind generation, and the lack of storage capacity relative to solar PV/wind capacity.

**Figure 2: Forecast generation and percentage of renewables vs government forecast**

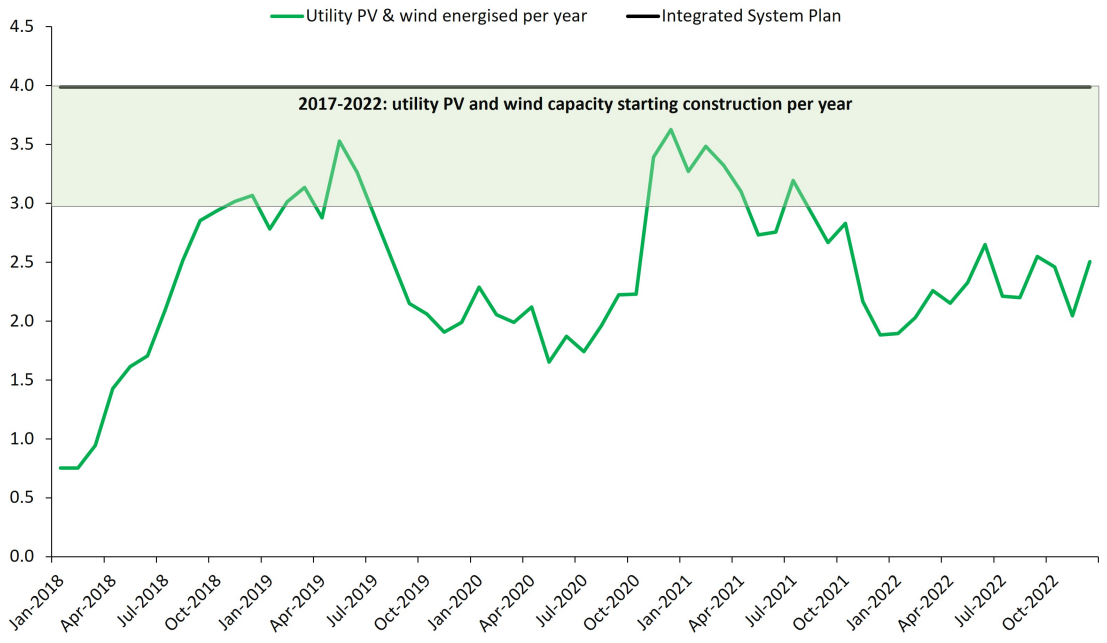



DER: distributed energy resources. BTM: behind the meter
Source: Rystad Energy research and analysis

**Why is Australia falling short of its target?**

**Commissioning constraints:** Australia needs to commission 4 GW of utility PV and wind per year in the NEM to keep pace with its targets. However, the empirical evidence (Figure 3a) shows that while Australia is beginning construction on approximately 3-4 GW/year of utility PV and wind, it is rarely able to commission more than 3 GW/year, due to the technical challenges of commissioning adding such large amounts of renewables to the grid. Furthermore, there has been a recent trend towards larger-scale projects over 400 megawatts (MW) in size in recent years which have a greater impact on the local network and typically take over a year to commission from energization. By contrast, smaller projects (<200 MW) typically commission in under 200 days.

**Figure 3a: Utility PV and wind capacity energized per year vs starting construction**
Gigawatts ($GW_{AC}$)




Source: Rystad Energy research and analysis

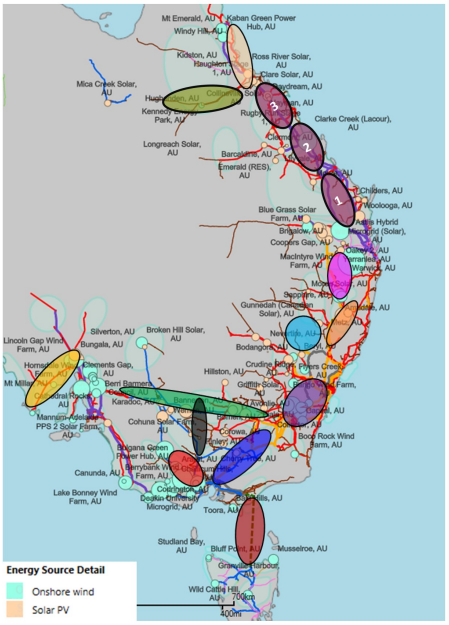
**Transmission constraints:** The second key hurdle is available capacity for new connections in the transmission system. Over the past five years, construction of solar and wind capacity in regional areas of Australia with good renewable resources has led to transmission lines becoming congested during peak renewables generation periods. To add sufficient renewables and storage to the grid to meet Australia's renewables goals, $A27 billion would need to be spent on transmission upgrades to 2035. The key risk with building transmission is gaining the social license for high voltage transmission towers over hundreds of kilometers from the renewables-rich areas of regional Australia to state capital cities by the coast. This is particularly relevant in NSW, where new transmission capacity is needed to continue the build out of utility PV and wind.


David Dixon
Rystad Energy

## Figure 3b: NEM transmission upgrades to 2035

Gigawatts (GW)

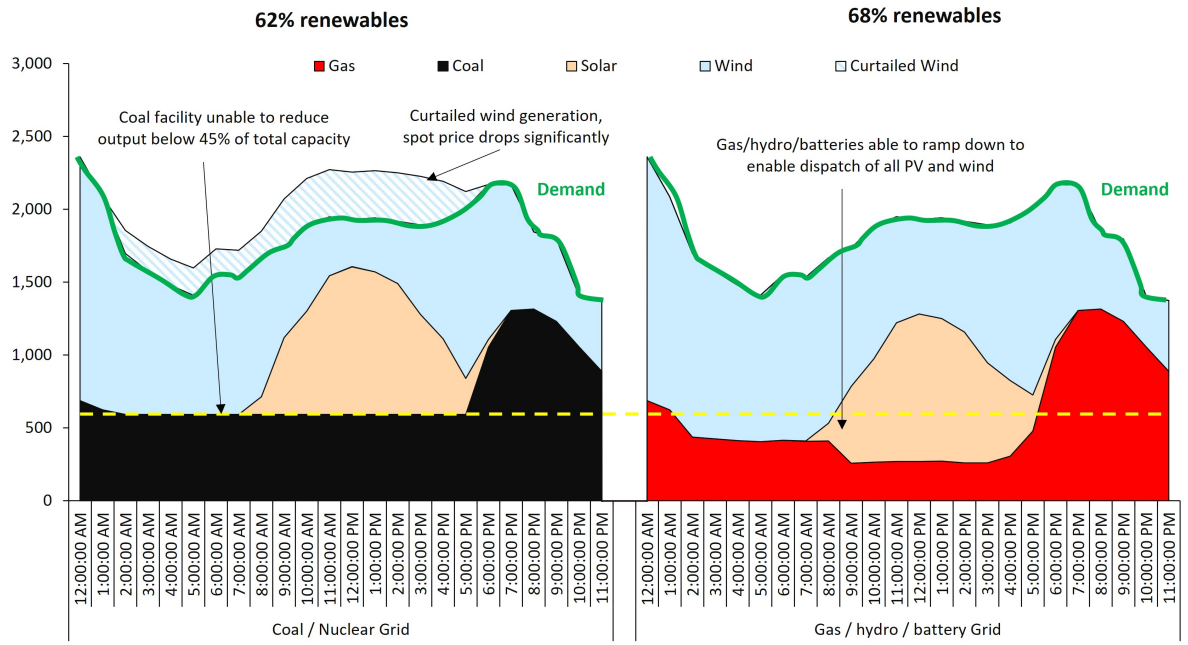
| Transmission project | Delivery | Capacity increase | Capex (AUD billion) | Status |
|---|---|---|---|---|
| VNI Minor | 2022 | 170 MW | 0.1 | Committed |
| Eyre peninsula link | 2023 | 240 MW | 0.3 | Committed |
| QNI Minor | 2023 | 150-190 MW | 0.2 | Committed |
| NQ REZ Stage 1 | 2023 | 500 MW of new generation in northern Queensland | 0.01 | Anticipated |
| Central West REZ (NSW) | 2025 | 3 GW | 0.5 | Anticipated |
| Energy Connect | 2026 | 800 MW | 2.3 | Anticipated |
| West VIC | 2026 | 1.5 GW | 0.4 | Anticipated |
| Humelink | 2026 | 2.2 GW | 3.3 | Actionable |
| New England REZ | 2027 | 3 GW | 1.9 | Actionable |
| Marinus link phase 1 | 2029 | 750 MW | 2.4 | Actionable |
| Marinus link phase 2 | 2031 | 750 MW | 1.4 | Actionable |
| VNI West | 2031 | ~1.85 GW | 3.3 | Actionable |
| QEJP Stage 1 | 2029 | >3 GW | 0.8 | Borumba - Gladstone |
| QEJP Stage 2 | 2031 | >3 GW | 1.3 | Central Queensland |
| QEJP Stage 3 | 2033 | >3 GW | 3.4 | Pioneer Burdekin – North Queensland |
| CuString* | 2028** | >3 GW | 5.0 | Hughenden |




*Prior to the announcement of Copper String, this was QEJP Stage 4 (delivery 2035, capex A$1.7 billion). **Estimated delivery date.
Source: Rystad Energy research and analysis

**The dispatchable capacity mix does not optimally compliment PV & wind:** In Australia's NEM, the bulk of non-renewables generation is run off black and brown coal. These facilities have a high minimum turndown capacity (40-60% of maximum capacity) and result in more renewables curtailment than more flexible gas, hydro and battery facilities which can ramp down to very low levels during periods of high renewable generation. Figure 3c gives an example of this impact, whereby both grids have the same demand, solar and wind generation available but are firmed by less flexible coal vs more flexible gas. The results show the impact of flexibility is a 6% increase in renewables generation for the grid with flexible dispatchable capacity, a concept examined in more detail in a previous commentary.

**Figure 3c: Comparison of non-flexible/flexible dispatchable renewable generation capacity**
Megawatts (MW)

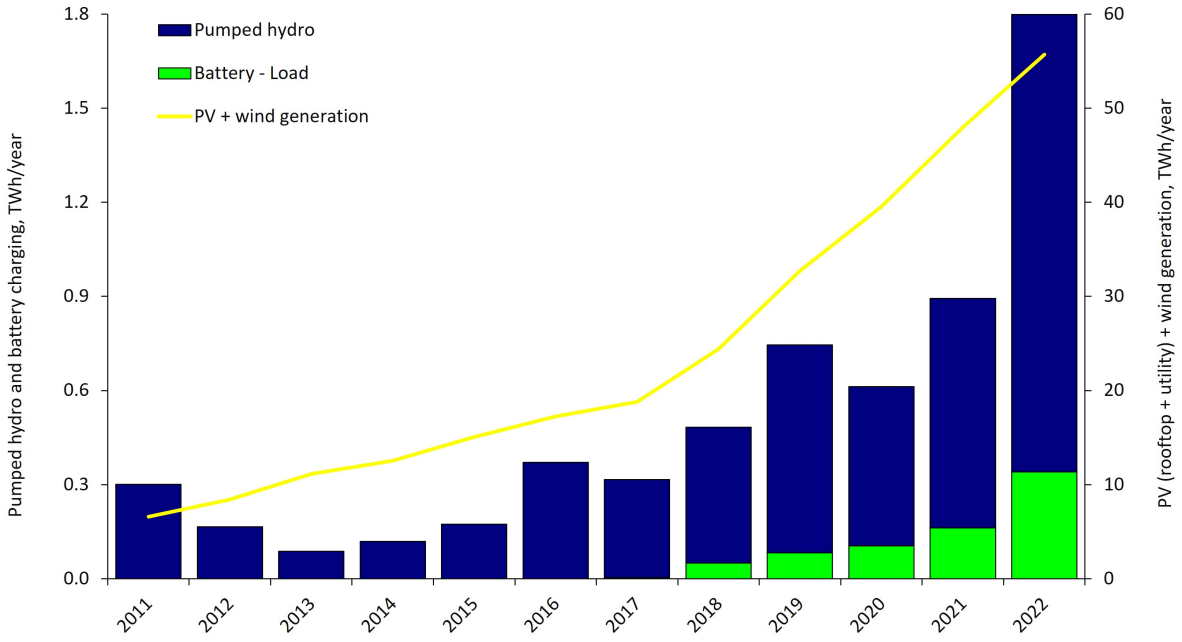



Source: Rystad Energy research and analysis

**Lack of storage capacity relative to solar PV/wind:** The final constraint limiting Australia's penetration of solar and wind generation is the lack of storage capacity that can store excess solar and wind generation for later use. As of April 2023, the NEM has 32 $GW_{AC}$ of operational solar PV (rooftop PV + utility) and wind. By comparison, just 2.5 $GW_{AC}$ of utility batteries and pumped hydro capacity is available. Furthermore, the 1.2 $GW_{AC}$ of utility batteries are most often used for frequency control ancillary services (FCAS) and less for shifting energy (energy arbitrage).

## Figure 3d: NEM battery & pumped hydro charging vs solar PV & wind generation

Terawatt-hours (TWh) per year




Source: Rystad Energy research and analysis

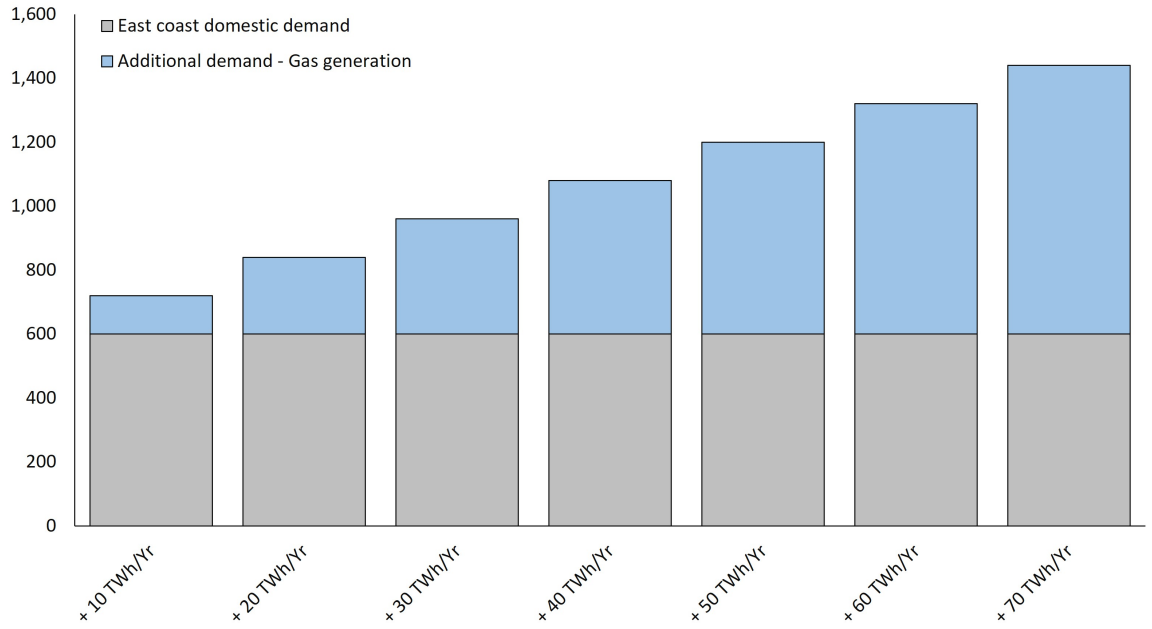
**What can be done?**

In this section, we explore potential solutions to increase the level of renewables penetration and help achieve the target of 82% by 2030. We assume that transmission projects will be commissioned on time, although in reality they are likely to be delayed. As a result, only solutions that do not involve accelerating transmission upgrades are explored.

**Switch from coal to gas plant for firming capacity:** Replacing under-utilized coal generating facilities with flexible gas capacity is a potential solution for increasing renewables penetration. As explored in Figure 3c, the flexibility of open-cycle or reciprocating gas turbines would allow for greater renewables dispatch and thus less curtailment. Rystad Energy considers this the least likely of the options to be explored, given the lack of appetite from the private sector to invest in new gas generation, given the carbon risk. Furthermore, the impact on Australia's east coast domestic gas demand is significant as shown in Figure 4a.

**Figure 4a: Gas consumption for different levels of additional gas generation**

Petajoules (PJ) per year




Source: Rystad Energy research and analysis

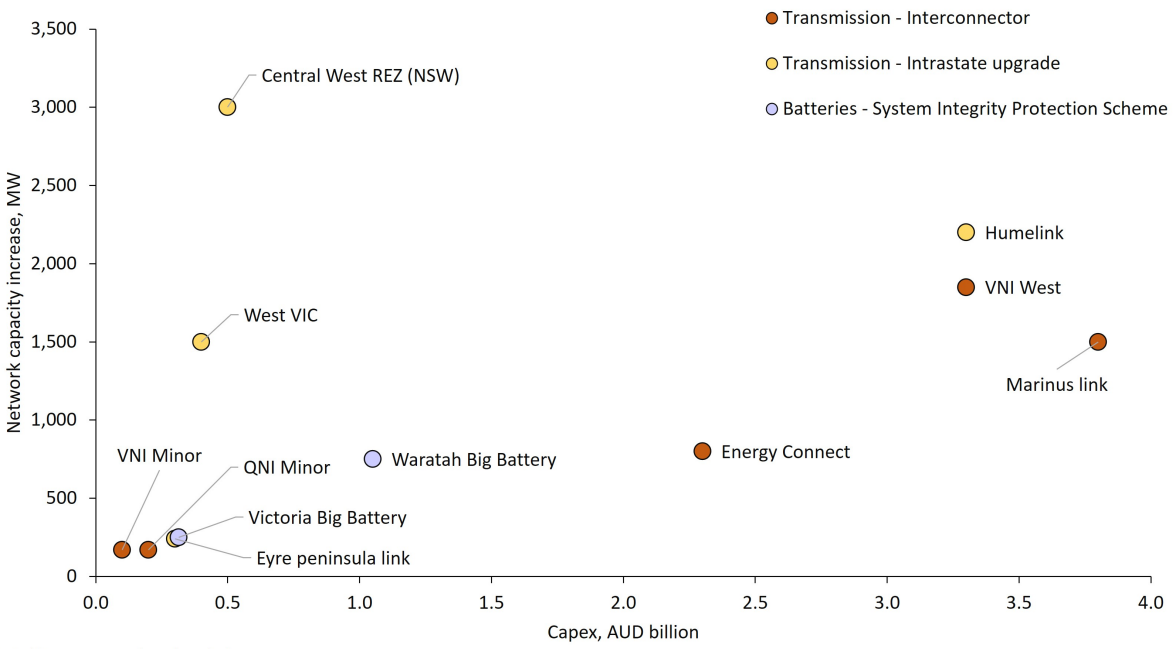
**Utility batteries as virtual transmission to decongest the existing network:** The second potential solution is to use utility scale batteries to provide additional network capacity during peak periods. This solution has already been adopted in Victoria and NSW via their respective System Integrity Protection Schemes (SIPS). In Victoria, Neoen was awarded the contract to build the 300 MW/450 megawatt-hour (MWh) Victoria big battery, which unlocks up to 250 MW of additional peak capacity on the existing Victoria-to-New South Wales Interconnector (VNI). Whilst in NSW, Akaysha has been awarded the SIPS contract for its 850 MW/1,680 MWh Waratah battery which is scheduled to be operational in 2H 2025. The key advantages of using batteries to increase capacity on the existing network include but are not limited to:

- Timeliness: Utility battery projects can be delivered in relatively short periods of time (1-2 years) compared to transmission. Given their relatively small footprint, they can also avoid the unknown risks associated with social license over land use.
- Cost competitive: Our economics analysis suggests a fixed annual payment to the battery operator of at least A$40,000/MWh/year would be sufficient for utility battery developers to secure debt financing. For a project such as the Neoen big battery (450 MWh), this would equate to A$18 million/year or A$270 million over a contracted 15-year period.
- Utilization during non-congested periods: The need for standby capacity to decongest existing transmission lines is typically seasonal and coincides with peak summer (or winter) periods. During non-peak periods, the battery can be used for other purposes such as FCAS or energy arbitrage.

This is an ideal solution for the medium term to 2030, as it provides certainty of revenue for battery developers to obtain debt to develop their projects, acts as a hedge against delayed transmission upgrades, and introduces more storage which can be used when not contracted for virtual transmission.

**Figure 4b: Network capacity increase vs capital expenditure**

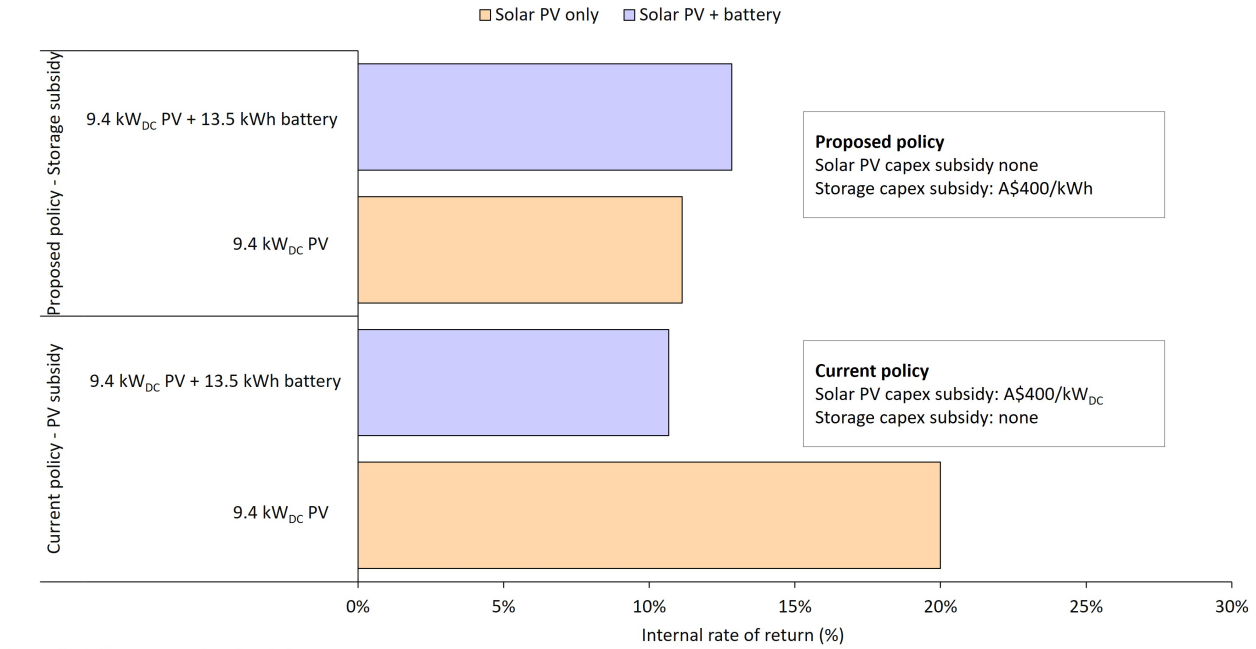
Megawatts (MW)




Source: Rystad Energy research and analysis

**Shift BTM incentives from rooftop solar to batteries:** Australia leads the world in rooftop solar thanks to the trifecta of excellent solar resource, a high proportion of detached houses enabling solar to be put on rooftops, and cheap rooftop PV system costs. The upfront grants received for system sizes below 100 kilowatts ($kW_{DC}$) declines annually but remains generous at around A$400/$kW_{DC}$. This up-front subsidy results in favorable economics for the consumer in most Australian capital cities. However, the pressing need is for more storage in the system to help reduce peak evening demand and create demand during daytime hours when solar is generating at its peak. Rystad Energy has investigated the economics of shifting the upfront subsidy from solar (~A$400/$kW_{DC}$) to storage (A$400/kWh). The analysis considered the economics of a rooftop solar system of 9.4 $kW_{DC}$ with and without an associated 13.5 kWh battery. The results of the analysis (Figure 4c) show that shifting the upfront subsidy to the storage component results in solar + storage having an internal rate of return (IRR) that is 2% higher than that of solar alone.

**Figure 4c: Comparison of current vs proposed policy settings for rooftop solar PV**
Percentage (%)

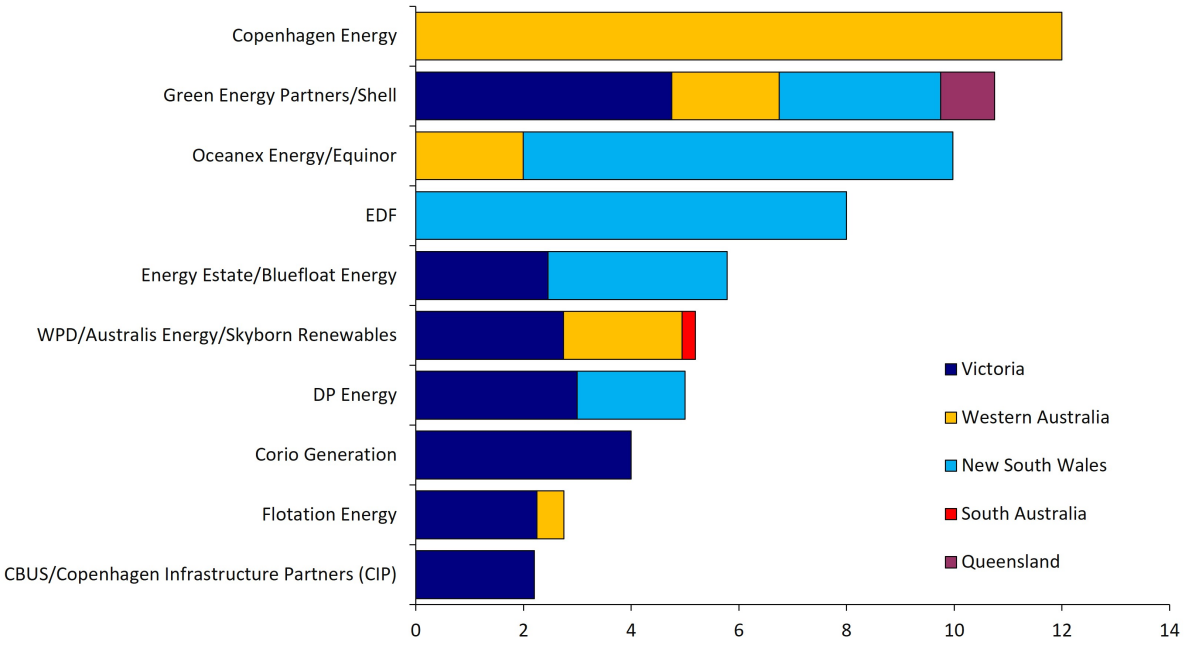



Source: Rystad Energy research and analysis

**NSW could consider offshore wind to hedge against transmission delays:** Offshore wind presents an opportunity for NSW to use existing high-voltage connection points near the coast. Offshore wind offers a diversity in resource relative to onshore wind, a higher capacity factor and closer connection to the main load centers (Sydney-Newcastle-Wollongong) but at a higher cost (2-3 times more) than onshore wind. A key difference between offshore wind projects planned in Victoria and potential projects in NSW is the foundation type. In Victoria, cheaper and more mature fixed bottom foundations are best suited to the state's shallow waters (<60 meters), whilst in NSW a more expensive floating design is required. Timeliness would also be an issue for offshore wind, which typically takes 3-5 years to construct and commission. Given the 2.2 GW Star of the South project offshore Victoria is the most mature offshore wind project in Australia and will not be energized until 2028 (assuming it goes to plan), it is unlikely that any offshore wind in NSW would be energized before 2030.

## Figure 4d: Top developers of offshore wind in Australia

Gigawatts ($GW_{AC}$)




Source: Rystad Energy research and analysis

**What would be the impact of incentivizing storage?**
The potential improvement of decongesting the transmission network with utility batteries and adding more BTM storage could result in 3-4% of additional renewables penetration. However, without faster build out of the network and associated utility PV/wind projects, it is unlikely that Australia will reach more than 70% renewables by 2030.

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Contacts

**David Dixon**, David Dixon is a vice president on the Renewables & Power team, focusing on Australasia and Asia-Pacific.

Phone: +61(0)405306822

david.dixon@rystadenergy.com

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For other inquiries,

support@rystadenergy.com

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# Storm ahead? Australia's wind, solar project approvals plunge 75% since 2018

*4 July 2023 - Renewables & Power Analytics*

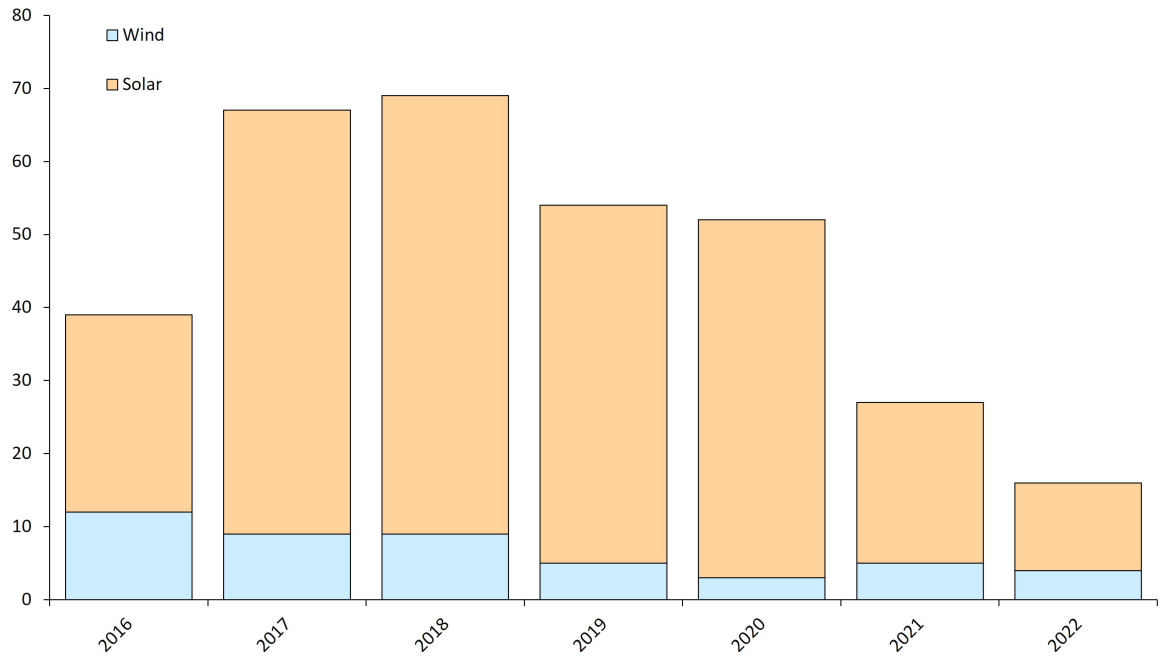
Australia risks falling behind in meeting state-based renewable energy installation targets through 2030 due to increasingly onerous project approval processes which are pushing out timelines and costs for developers. Rystad Energy analysis shows that approvals for utility scale wind and solar projects have plunged by 75% since 2018, compounding the commissioning challenges faced by developers which include supply chain issues, transmission project delays and a shortage of back-up storage capacity. New South Wales (NSW) is the state most impacted by delays in project approvals, putting it at real risk of not approving enough capacity in time to meet its 2030 target of 12 gigawatts (GW) of operational utility solar PV and wind. However, warning signs are emerging in Victoria where project approvals are slowing relative to the build out needed to reach its target of 65% renewables by 2030. Any delay in meeting state-based installation targets could limit Australia's ability to phase out coal generation and reduce emissions through 2050.

**Utility wind, solar project approvals down 75% since 2018**

Utility solar and wind project approvals in NSW, Queensland and Victoria combined have plunged over 75% between 2018 and 2022. Our analysis shows that 2022 is the first year since 2016 in which under 4 GWAC of utility solar and wind capacity was approved in the three states combined.

**Figure 1a: Approved projects in Queensland, Victoria and NSW by type and approval year**

Number of projects

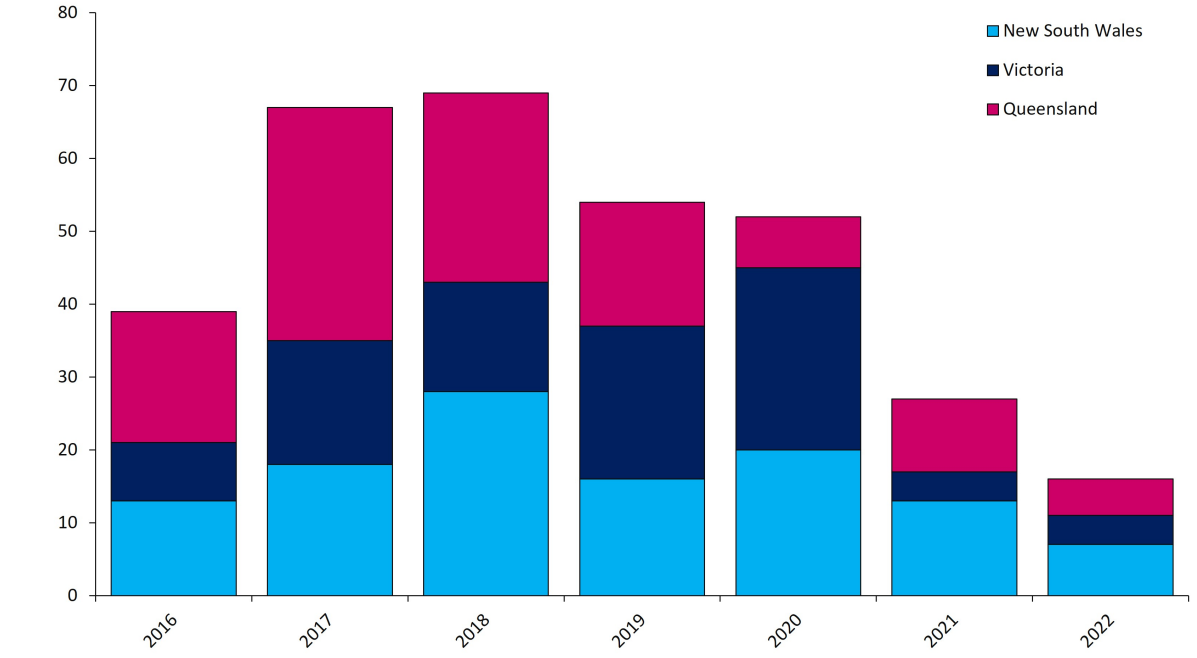



Source: Rystad Energy RenewableCube

David Dixon
Rystad Energy

**Figure 1b: Number of approved utility solar & wind projects by state and approval year**

Number of projects




Source: Rystad Energy RenewableCube

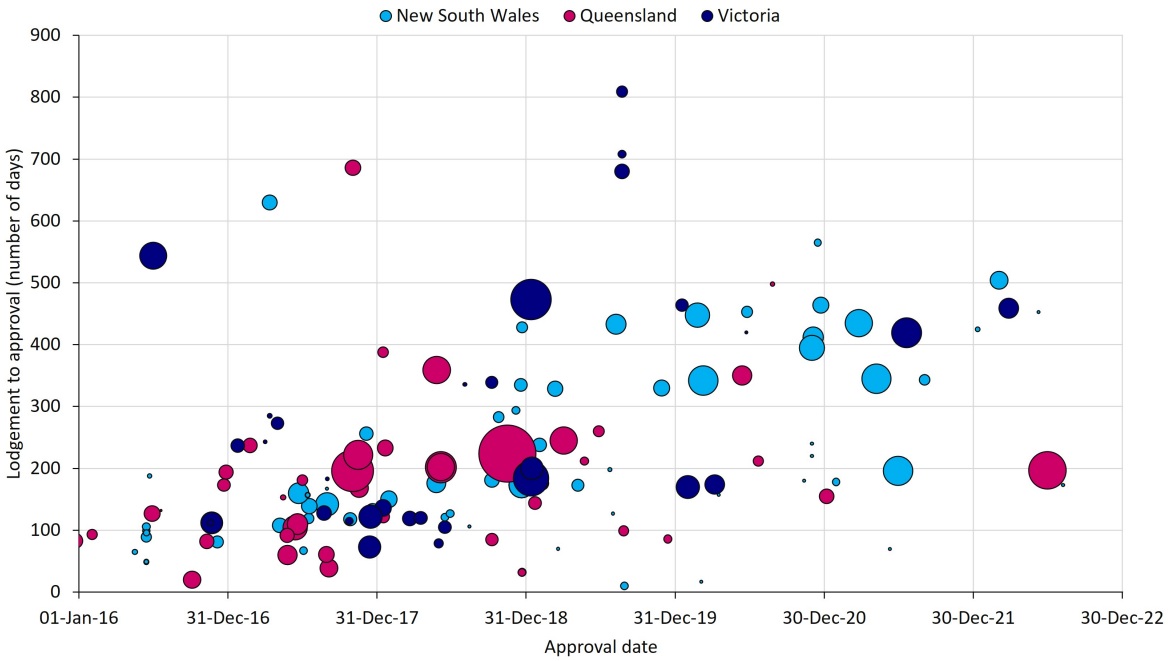
**Why is this happening?**

According to industry participants contacted by Rystad Energy, project approvals are becoming more costly, difficult and time-consuming for the following reasons:

- Planning departments are asking for too much information, much of which is not needed or even known with reasonable certainty at the time of lodging a development application (DA).
- Planning departments are often rescheduling or cancelling site visits needed to allow developers to progress their DA.
- Requirements to engage other government agencies prior to lodging a DA is adding further time and complexity. These agencies are often not adequately resourced to perform the work required for renewable energy proposals.
- Planning departments are often rejecting the lodgment of DAs to satisfy internal timing metrics associated with evaluating DAs from lodgment to decision. Multiple participants commented that this was a particular problem in NSW.
- NSW is pushing developers to install their projects at more challenging locations, leading to more issues with biodiversity, topography geotechnical and cultural heritage, adding to time and cost.
- The cost of DAs has increased substantially, particularly in NSW.

The impact of this added bureaucracy and engagement with other government agencies is adding to development costs and pushing out the duration of project approvals. This latter point is being reflected in our data, with solar and wind project approvals now taking 1.5-2 years on average compared to 6-12 months previously.

## Figure 2: Application duration by asset and state

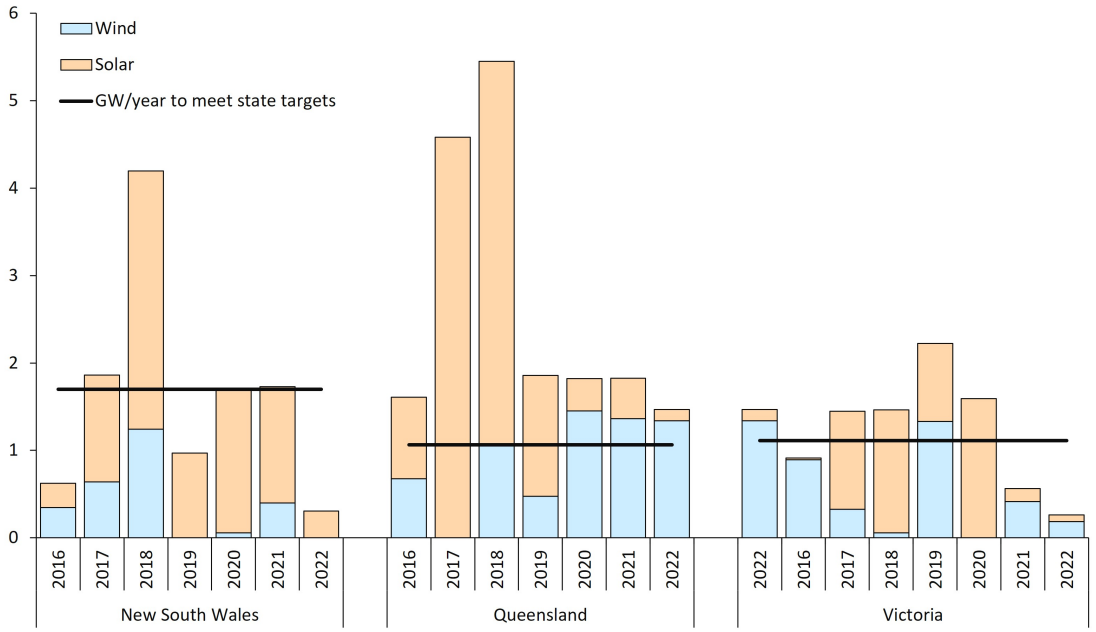



*Bubble size is proportional to asset capacity
Source: Rystad Energy RenewableCube

**Which state is most at risk?**
NSW is the state most at risk of not being able to meet its 2030 renewable energy installation targets. This is due to it needing more capacity build out (1.7 GW / year) than other states and its more challenging approval process, meaning less capacity is being approved. However, warning signs are also emerging in Victoria, although the deficit of project approvals to the capacity needed to start construction is not as dramatic as NSW. Queensland is the only state in which project approvals have consistently outpaced the capacity required to meet its state-based renewable target of 50% by 2030.


David Dixon
Rystad Energy

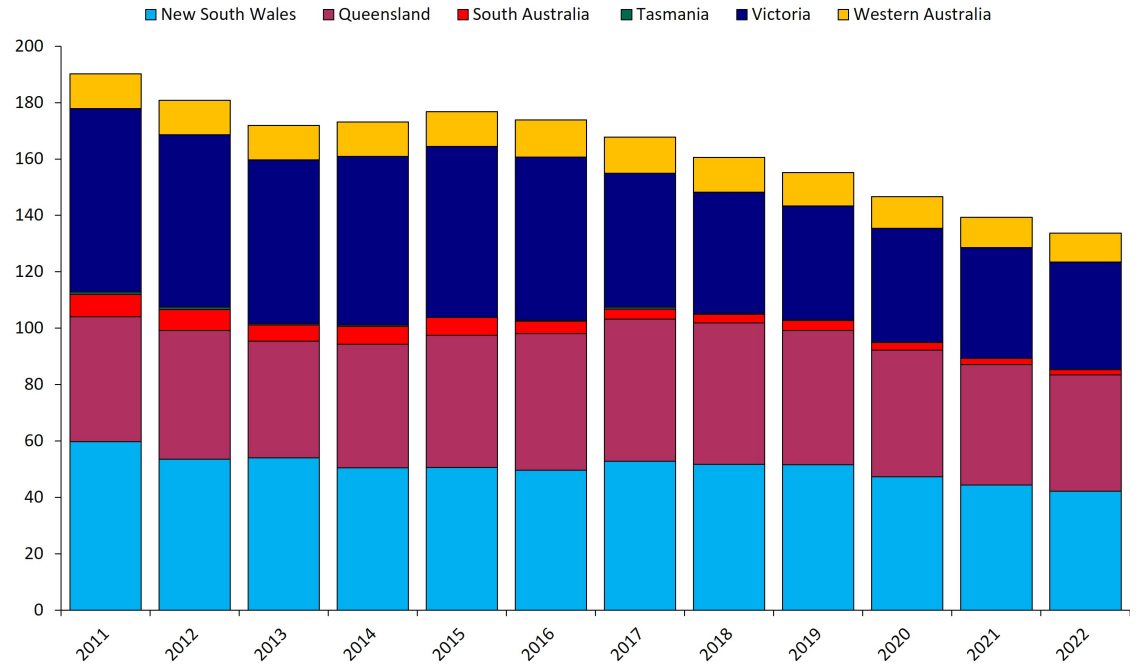
**Figure 3: Annual capacity approved vs capacity required to meet 2030 state targets**
Gigawatts (GW)




Source: Rystad Energy RenewableCube

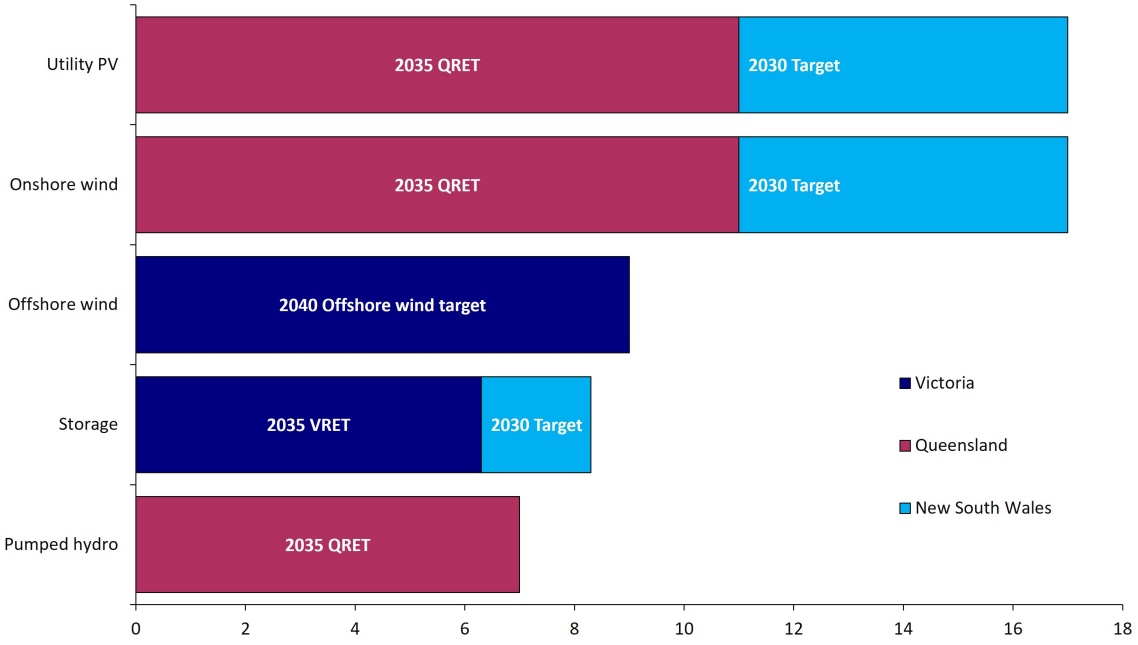
**Why does this matter?**
NSW, Queensland and Victoria are Australia's three largest states in terms of electricity generation, accounting for 184 terawatt-hours (TWh) in 2022 or 80% of total generation in eastern Australia's interconnected National Electricity Market (NEM) and Western Australia's isolated Wholesale Electricity Market (WEM) combined. Furthermore, NSW, Queensland and Victoria account for a combined 90% of emissions from the NEM and the WEM, hence transitioning to renewables in Australia requires most of the utility solar/wind to be built in these three states. Rystad Energy estimates that, on average, 4 GWAC of utility wind and solar will need to start construction per year through to 2050 to enable Australia to transition away from coal-fired generation. At present, Australia is trailing behind this schedule by about 0.6 GW per year.

**Figure 4a: Emissions by state over time from electricity generation**
Millions of tonnes of $CO_2$ equivalent




Source: Rystad Energy RenewableCube

**Figure 4b: Capacity targets for renewables, pumped hydro and storage to 2040 by state***
Gigawatts (GW)




*QRET: Queensland Renewable Energy Target. VRET: Victoria Renewable Energy Target.
Source: Rystad Energy RenewableCube

Contacts

**David Dixon**, David Dixon is a vice president on the Renewables & Power team, focusing on Australasia and Asia-Pacific.
Phone: +61(0)405306822
david.dixon@rystadenergy.com

**Alokita Shukla** , Alokita Shukla is an analyst with the Renewables & Power team, based in Bangalore.
Alokita.Shukla@rystadenergy.com

For other inquiries,
support@rystadenergy.com