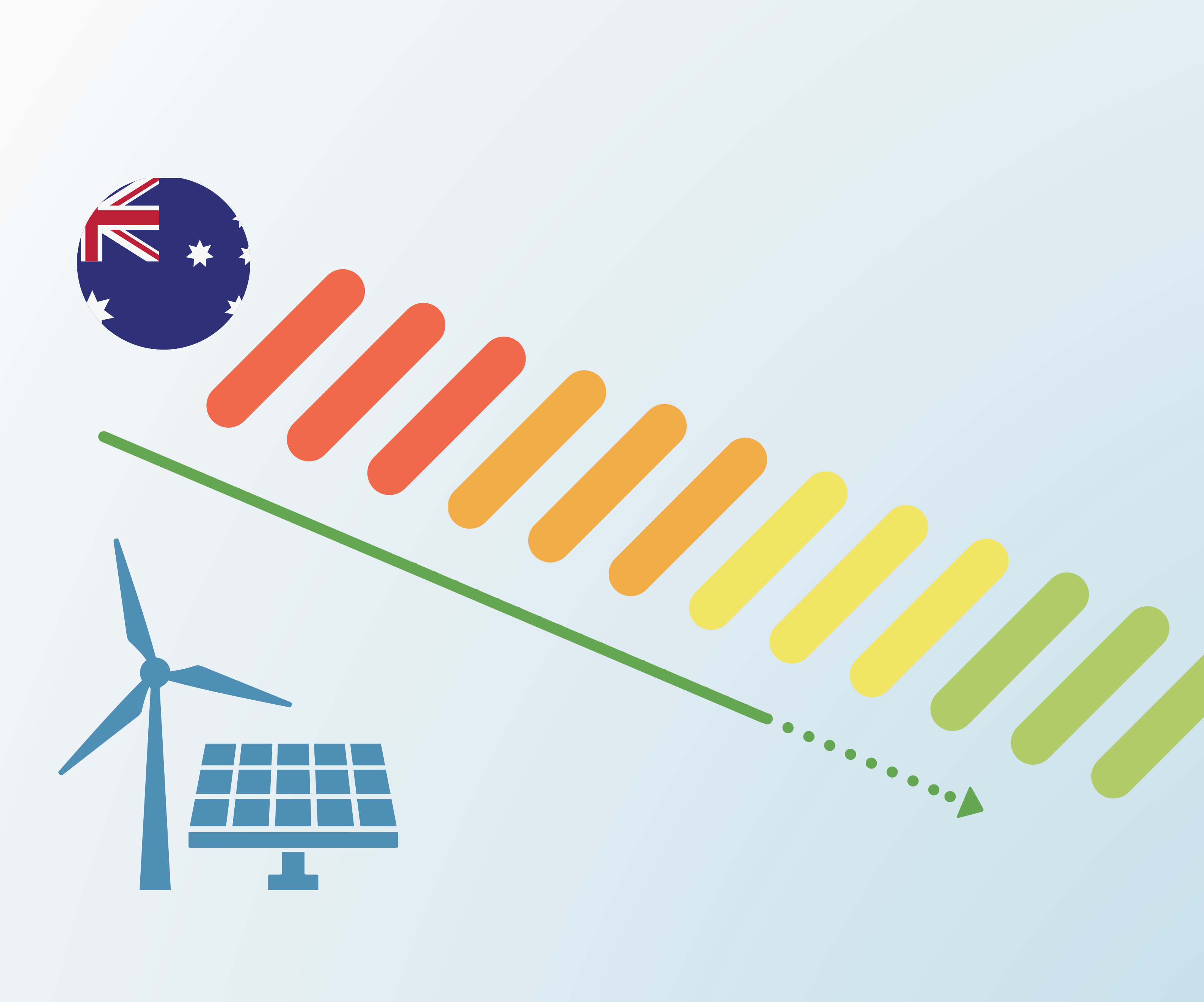


Climate Action Tracker

Wind and Solar benchmarks for a 1.5°C world

AUSTRALIA

February 2026

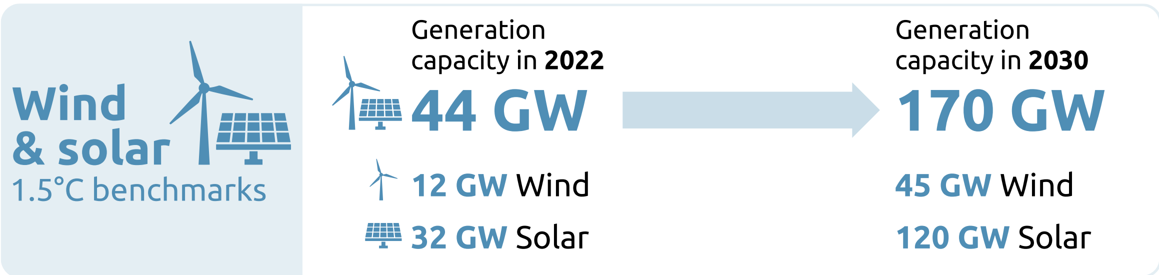
Executive Summary

Context

- Australia has abundant potential for wind and solar. At the same time, it is heavily dependent on coal, which still provided almost two-thirds of electricity generation in Australia in 2023.
- The Australian Government has set a target of achieving 82% renewable electricity by 2030.
- In this report, we look at national studies and global energy system models to assess how much Australia's wind and solar capacity needs to grow to align with the global goal to triple renewables by 2030 and the Paris Agreement's 1.5°Cwarming limit.

Key findings

- Australia's wind and solar generation needs to grow between four and five times by 2030 to align with 1.5°C. This equates to 280–330 TWh of wind and solar generation in 2030, up from 64 TWh in 2022.
- Almost 170 GW of wind and solar would be needed by 2030 (120 GW solar, 45 GW wind).
- Australia's current rollout of wind and solar is not progressing fast enough to achieve this. Under current policies and market conditions, only half of the solar and 60% of the wind needed to align with 1.5°C will be installed by 2030.



Context

At COP28, governments agreed to triple global renewable capacity by 2030 globally to stay in line with 1.5°C. This report highlights the potential implications of this COP28 decision at the national level, focusing on **Australia**.

Wind and solar deployment is accelerating around the world. However, expected wind and solar capacity deployment under current policies falls short of what is needed for 1.5°C, and is concentrated mainly in a few regions.

Research is needed to understand the pace of wind and solar deployment that aligns with the highest plausible ambition and is compatible with 1.5°C

This project aims at answering the following questions:

- **How much wind and solar generation is needed (TWh) at the national level?**
- **How much wind and solar needs to be built (GW of capacity)?**
- **When does it need to be built by, and how quickly?**

Policy context

Australia's 2030 NDC is to cut emissions 43% below 2005 levels including LULUCF. The country aims to reach net zero GHGs by 2050.

Australia also aims to reach 82% of renewables in electricity generation by 2030, but under current policies, will only reach a 63% share in 2030. Under current policies and market conditions, the IEA estimates that **solar capacity in Australia will reach 68 GW in 2030**, up from 32 GW of solar in 2022. Meanwhile, **wind capacity is projected to reach 29 GW in 2030**, up from 12 GW in 2022.

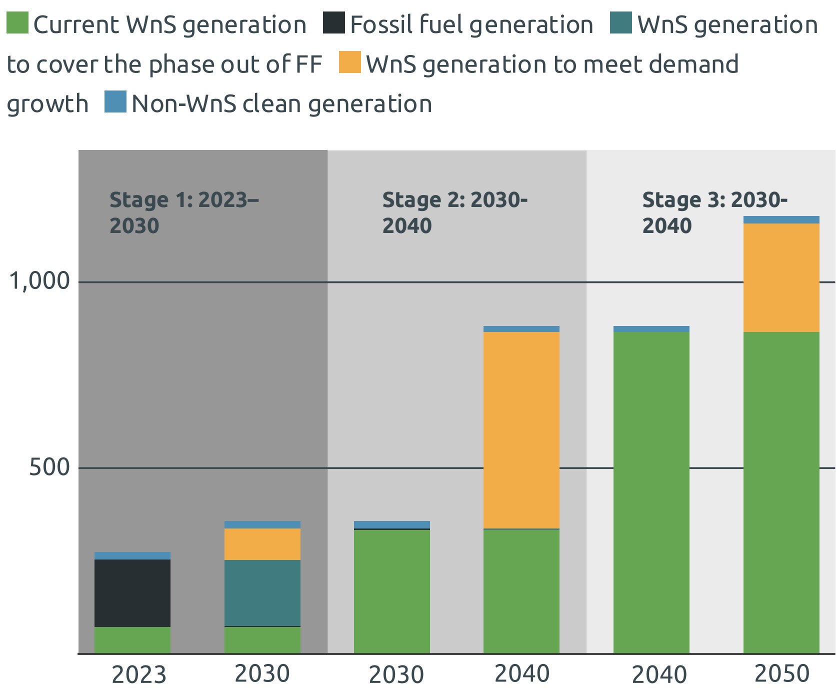
National enabling factors

Key enabling factors for ambitious wind and solar rollout include:

- **Institutional capacity.** A rapid build-out of wind and solar will require the governance and institutional capacity to develop, implement and enforce policy frameworks.
- **Just transition.** A just transition will be needed to take along all stakeholders, particularly those employed by the fossil economy.
- **Grid development.** Substantial increases in both transmission and distribution grid infrastructure will be necessary to integrate large-scale new wind and solar generation into the power system.
- **Fossil fuel phase-out.** Existing fossil fuel infrastructure often will need to be retired earlier than its economic lifetime. Policies need to be developed to achieve the early phase out of fossil fuel plants.
- **System flexibility.** Energy storage (diurnal and seasonal), flexible generation technologies such as hydro and geothermal, and increased demand side flexibility will all be crucial.
- **Market design.** Reform of market designs and regulation adapted to RE-based systems that incentivise and mobilise investments to install renewable energy at the scale needed (e.g., minimise cost of capital, ensure revenue certainty, etc).

Results

Stages of power sector decarbonisation



The stages of the electricity system transition in Australia

WnS = Wind and Solar

Figure 1 – Electricity generation in each stage in TWh

In a 1.5°C pathway, countries must add solar, wind, and other clean technologies to meet rising power demand while replacing phased-out fossil fuels. The evolution of the power capacity mix over successive decades varies across countries.

From now until 2030, Australia would need to add 10 GW of wind and 26 GW of solar capacity to meet growing demand alone. Another 21 GW of wind and 56 GW of solar will be needed to displace the share of fossil fuels in the electricity generation mix.

Power sector transformation and the increasing participation of variable renewable energy (VRE) – mainly wind and solar – in a country's power mix gives rise to a set of technical challenges linked to the integration of VRE sources. Six phases can be distinguished here, from phase 0 (pre-development with negligible amount of VRE shares) to phase E (with over 80% VRE shares). More information about these phases can be found in Annex A.

Meeting the benchmarks for 2030 will put Australia in Phase E, with wind and solar making up 94% of the generation mix. The power system reaches very high VRE penetration. The primary challenge becomes ensuring adequacy during extended periods of low wind and solar availability. Addressing this requires long-duration energy storage, sector coupling allowing for export and import of power between economic sectors in the same country and extensive electricity trade both within regions and between countries.

Figure 1 and Table 1 both show the stages of the transition to a decarbonised power sector in terms of the volumes of existing wind and solar and what is needed to displace fossil fuels and meet demand increases. Figure 1 shows the stages in terms of electricity generation, and Table 1 shows it in terms of generation, capacity and share of the electricity mix.

Table 1: Stages of the electricity system transition detailing how much generation capacity of wind and solar will be needed to displace fossil fuels in the system and meet growing electricity demand

	2023		2030		2040		2050
Grid integration phase (share of variable renewable energy in total electricity generation)							
Phase	Phase C		Phase E		Phase E		Phase E
Share of VRE	**< 40 %**		**> 85 %**		**> 85 %**		**> 85 %**
Share of electricity generation							
Wind & Solar	**27 %**		**94 %**		**98 %**		**98 %**
Other renewables	6.9 %		5.6 %		1.7 %		1.7 %
Fossil Fuels	**66 %**		**0.8 %**		**0 %**		**0 %**
Generation capacity							
To displace fossil fuels		**+78 GW**		**+1.5 GW**		**+ 0 GW**	
Wind & Solar	**54 GW**	**+17 GW/yr**	**170 GW**	**+27 GW/yr**	**440 GW**	**+11 GW/yr**	**550 GW**
To meet demand increase		**+36 GW**		**+270 GW**		**+110 GW**	
Generation							
Total	**270 TWh**	33%	**360 TWh**	150%	**880 TWh**	36%	**1200 TWh**
Wind & Solar	73 TWh		340 TWh		870 TWh		1200 TWh
Generation Capacity of VRE (variable renewable energy)							
To displace fossil fuels			21 GW		0.2 GW		0 GW
Wind capacity	**14 GW**		**45 GW**		**89 GW**		**150 GW**
To meet demand increase			10 GW		43 GW		60 GW
To displace fossil fuels			56 GW		1.2 GW		0 GW
Solar capacity	**40 GW**		**120 GW**		**350 GW**		**400 GW**
To meet demand increase			26 GW		220 GW		52 GW

Note: Numbers are rounded to two significant figures, which may contribute to minor differences in totals. The calculations assume that wind, solar, and other renewables contribute equally and proportionally to displacing fossil fuels and meeting demand growth.

Future electricity demand

Electricity demand is taken from Net Zero Australia's study exploring net zero pathways for Australia. We take demand from the rapid electrification pathway, which achieves nearly full electrification of transport and buildings by 2050, and has large- scale renewables build out.

In this scenario, total electricity generation in Australia more than quadruples by 2050 relative to 2022 levels, reaching 1200 TWh. This is driven by increased electrification of the Australian economy, and demand for electricity to produce clean fuels for export (particularly green hydrogen and ammonia derivatives). Over half of electricity demand would be used to for clean fuel export demand.

However, there is a significant range in the studies in terms of the expected electricity generation in 2050 ranging from 436 TWh to 1265 TWh. This would affect the necessary growth of wind and solar significantly. Our demand estimate is at the higher end of that estimated by country-level studies.

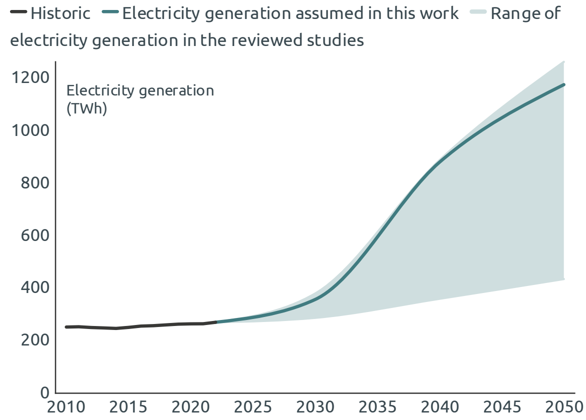


Figure 2 –Total electricity generation in TWh

Electricity generation grows 4x in Australia, partly to meet demand for clean exports

The solid line shows the electricity generation projection used to develop the benchmarks

Pace of fossil fuel phase-out needed

The rate of fossil fuel phase-out is set by the overlap between country-level studies, downscaled 1.5°Ccompatible global pathways and the global milestones of the IEA's Net Zero roadmap, in which Australia achieves a clean power system by 2035.

To align with 1.5°C, fossil fuels must exit the Australian power sector before 2035.

Fossil fuel generation falls by 69 to 98% between 2022 and 2030.

To align with 1.5°C, fossil fuels must exit the power sector in Australia by 2035, even as electricity demanding rows rapidly.

Australia would need to achieve clean electricity by 2035

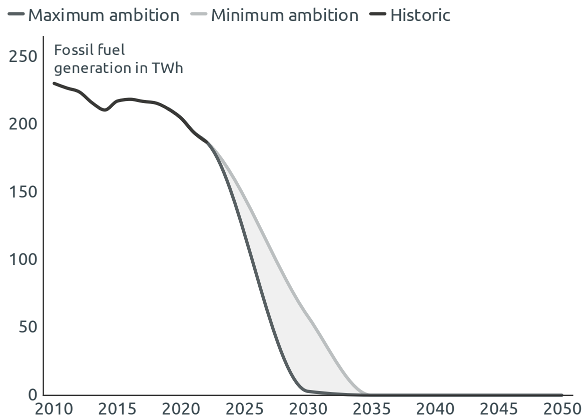


Figure 3 – Fossil fuel generation in TWh

Coal and gas phase-out in Australia

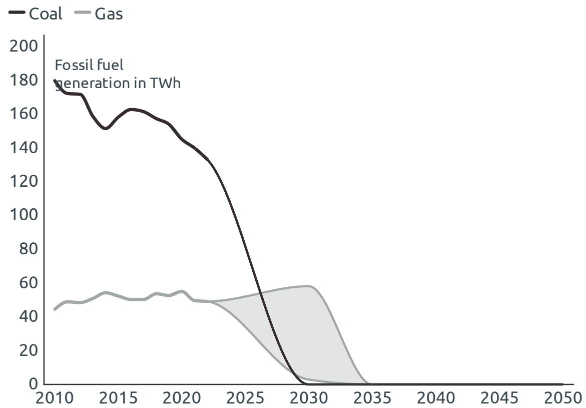


Figure 4 – Fossil fuel generation by fuel type in TWh

The role of other clean electricity generation

While wind and solar will be the workhorse of the energy transition, other clean electricity generation may play a role. We estimate the role of non- wind and solar clean electricity generation* (largely hydro, biomass, nuclear and geothermal) from country-level studies.

In our modelling, we assume that generation from clean technologies other than wind and solar in Australia would remain around 20 TWh over 2030 to 2050. This generation is provided largely from hydropower (around 15 TWh), with a small amount of biomass (3-4 TWh). The benchmarks do not assume any deployment of nuclear in the Australian power sector.

Total wind and solar generation needed to align with 1.5°C

The wind and solar rollout is then calculated by combining projected electricity demand growth, the fossil phase-out necessary to align with 1.5°C, and the assumed generation from other clean technologies.

To align with 1.5°C, **wind and solar generation in Australia would need to reach between 280 and 330 TWh by 2030**. Generation in 2023 was 64 TWh. This is therefore a 4 to 5-fold growth in wind and solar.

Wind and solar provides 78–94% of overall electricity generation in 2030, and 98% of overall generation in 2050. A grid powered almost entirely by wind and solar would require substantial rollout of batteries and energy storage, support from dispatchable generation such as hydro and geothermal, flexible demand and grid extension to ensure reliability of the system.

To align with 1.5°C, wind and solar generation would need to grow rapidly in Australia

Wind and solar generation needs to grow 4-5x by 2030 relative to 2022 in Australia

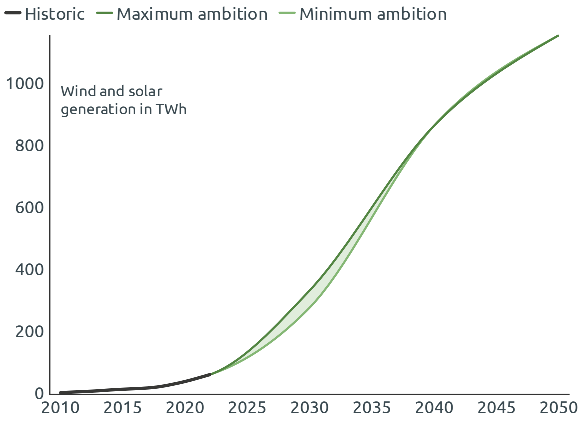


Figure 5 – Wind and solar electricity generation in TWh

Wind and solar need to provide over 95% of electricity generation in Australia by 2050

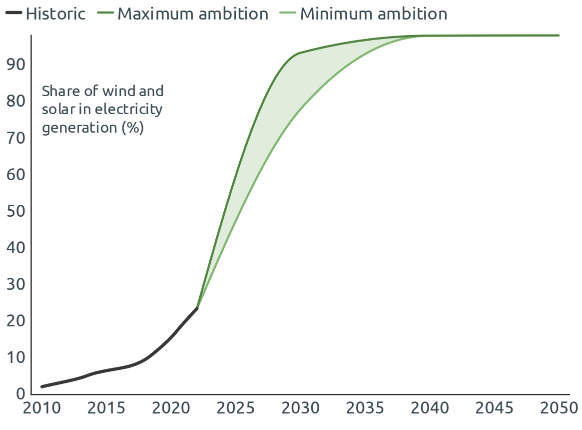


Figure 6 – Wind and solar electricity generation share (%)

* We do not consider CCS in the power sector, as we do not consider CCS a viable source of large-scale emissions reductions in the power sector.

Possible splits between wind and solar

The relative share of wind and solar deployment will vary depending on how various factors develop in the future. We explore one key uncertainty, the relative cost of solar and wind electricity generation (see methods). When accounting for this uncertainty, we see a range of possible future generation mixes between wind and solar.

We highlight the median of the range as our **central benchmark**, but do not suggest that this is the only possible breakdown into wind vs. solar. In the central benchmarking scenario, there is a relatively balanced contribution of wind and solar in the electricity mix by 2050. However, solar ramps up faster in the near-term, providing almost twice the electricity generation as wind in 2035.

In this scenario, **Australia would need to deploy almost 170 GW of wind and solar by 2030 to align with the 1.5°Ctemperature limit**. By 2050, total wind and solar capacity would need to reach to over 500 GW.

Australia needs to reach almost 170 GW of wind and solar installed capacity 2030 to align with 1.5°C

Solar capacity in Australia would reach 120 GW by 2030 in a 1.5°C-aligned scenario

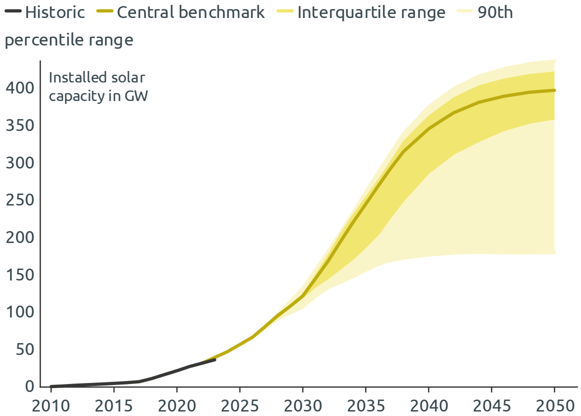


Figure 7 – 1.5°C compatible capacity benchmarks for solar in GW

Wind capacity in Australia would reach 45 GW by 2030 in a 1.5°C-aligned scenario

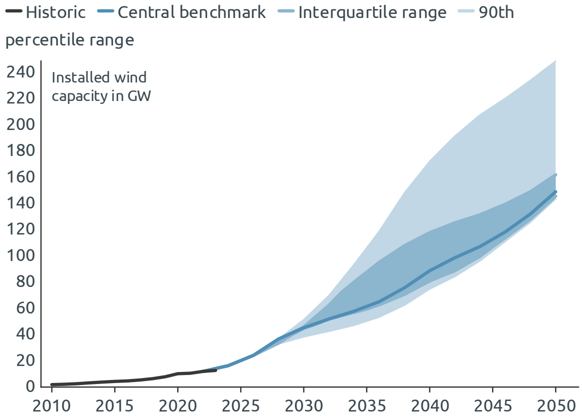


Figure 8 – 1.5°C compatible capacity benchmarks for wind in GW

Note: The benchmarks assume action from 2022.

The following table shows the wind and solar deployment needed to align with the central 1.5°C compatible benchmark produced. 2022 is historical data. All benchmark data from 2030 onwards is reported to two significant figures.

Table 2: Wind and solar electricity generation and capacity (2022–2050)

Scenario	Variable	Unit	2022	2030	2035	2040	2050
Central 1.5°Cbenchmark	Solar generation	TWh	36	180	390	560	620
Central 1.5°Cbenchmark	Wind generation	TWh	31	140	200	300	560
Central 1.5°Cbenchmark	Solar capacity	GW	32	120	250	350	400
Central 1.5°Cbenchmark	Wind capacity	GW	12	45	62	89	150

Table 3: Benchmarks translated into CAT format

Variable	Ambition	Unit	2030	2035	2040	2045	2050
Share of coal	Minimum	%	0	0	0	0	0
	Maximum	%	0	0	0	0	0
Share of gas	Minimum	%	16	0	0	0	0
	Maximum	%	1	0	0	0	0
Share of renewables	Minimum	%	84	100	100	100	100
	Maximum	%	99	100	100	100	100
Share of wind and solar	Minimum	%	78	97	98	98	98
	Maximum	%	94	97	98	98	98

Comparison to current rollout and country target

Under current policies and market conditions, deployment of wind and solar PV in Australia would not align with 1.5°C. There would be a capacity gap of **52 GW of solar PV** and **16 GW of wind** missing in 2030 between current rollout and the 1.5°C compatible benchmarks highlighted here.

There is strong support from business for high ambition from the government to phase out fossil fuels and transition the electricity system to be powered by renewables, with 77% of executives in Australia polled in the Global Business Poll wanting to see this transition by 2035.

Australia's rollout of wind and solar needs to accelerate to align with 1.5°C

In Australia, current rollout of solar is lagging behind 1.5°C-aligned levels

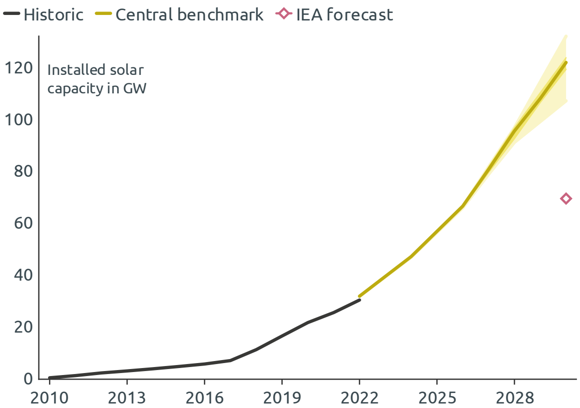


Figure 9 – Installed solar capacity in 2030 compared to targets and current policy projections in GW

In Australia, current rollout of wind is lagging behind 1.5°C-aligned levels

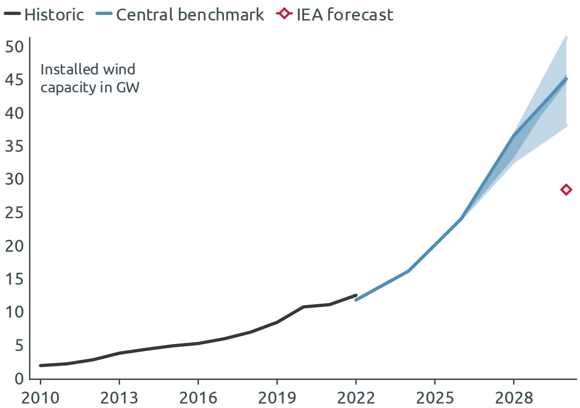


Figure 10 – Installed wind capacity in 2030 compared to targets and current policy projections in GW

Note: The target data was last pulled from Ember in January 2025. The current policies data was last pulled from the IEA in June 2025. The benchmarks assume action from 2022.

Wind and solar capacity additions in Australia need to accelerate to align with 1.5°C

Australia would need to add on average 11.0 GW/yr of solar capacity until 2030, and 14.0 GW/yr by over 2030–2050

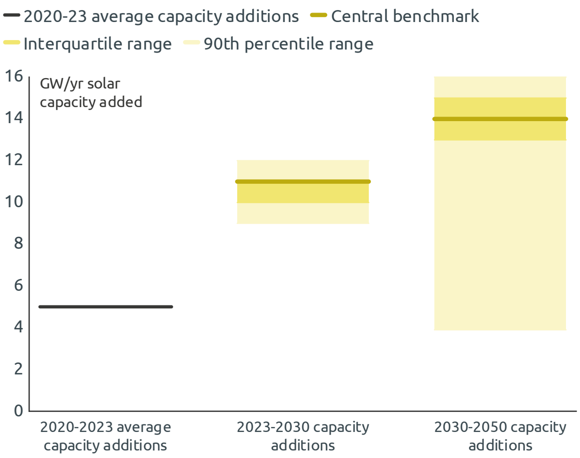


Figure 11 – Solar capacity additions per year in GW/y

Australia would need to add on average 3.9 GW/yr of wind capacity until 2030, and 5.6 GW/yr by over 2030–2050

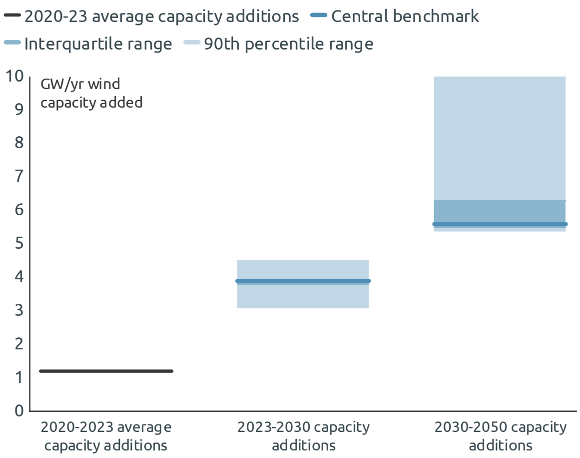


Figure 12 – Wind capacity additions per year in GW/y

Comparison with other studies

We compare the wind and solar generation seen in our analysis to that in the literature review of country-level studies. We highlight the results of modelling from the Net Zero Australia, exploring net zero pathways for Australia, where we particularly highlight the results from the *Rapid Electrification* scenario (E+).

We see that the wind and solar generation that our method produces is broadly comparable to the Net Zero Australia modelling in 2050. However, our benchmarks envisage a faster rollout of solar in the 2030s and a slower rollout of wind than the Net Zero Australia modelling.

Our benchmarks are broadly aligned with the literature

Electricity generation from solar: comparison with literature in Australia

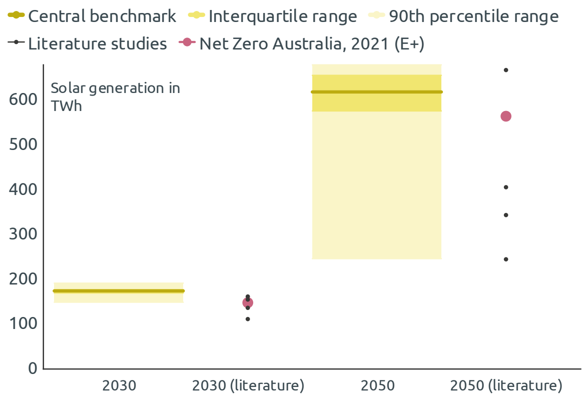


Figure 13 – Solar electricity generation in TWh

Electricity generation from wind: comparison with literature in Australia

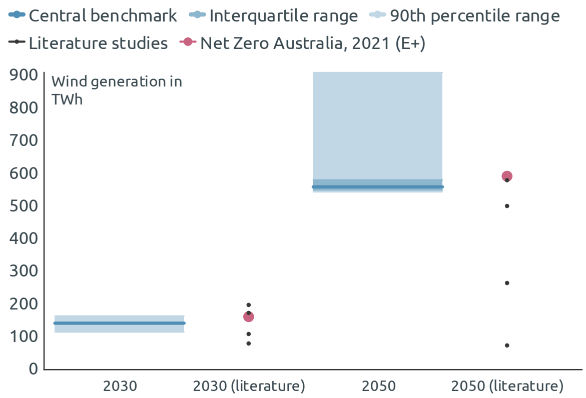


Figure 14 – Wind electricity generation in TWh

In Australia, our benchmarks generally suggest that relatively even contribution of wind and solar

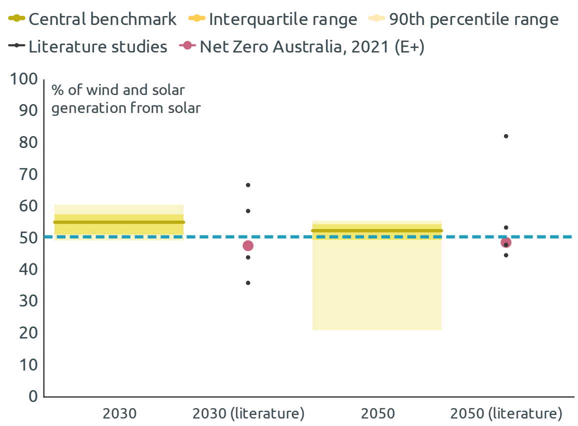


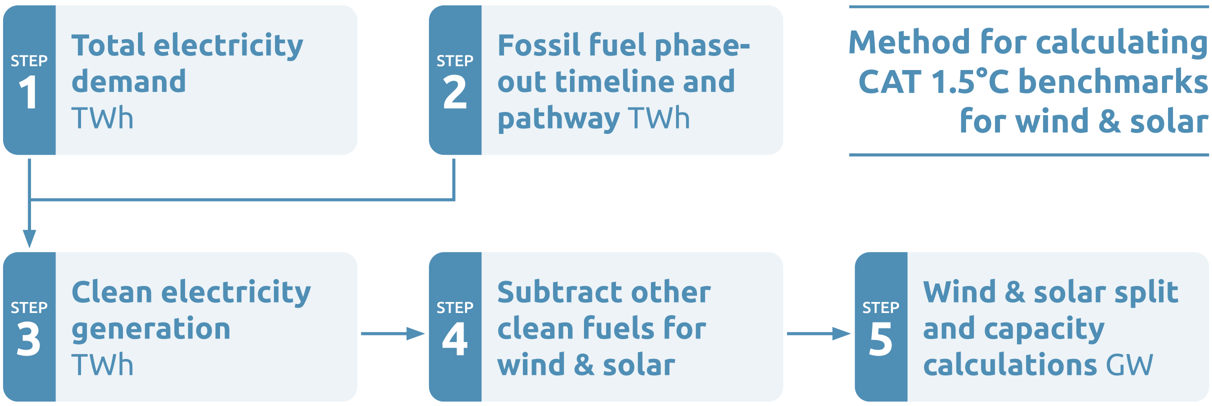
Figure 15 – Generation split between wind and solar (%)

Share of wind and solar generation that comes from solar: comparison with literature in Australia

The area above the blue dashed line represents a power system in which solar provides more electricity generation than wind

Methodology

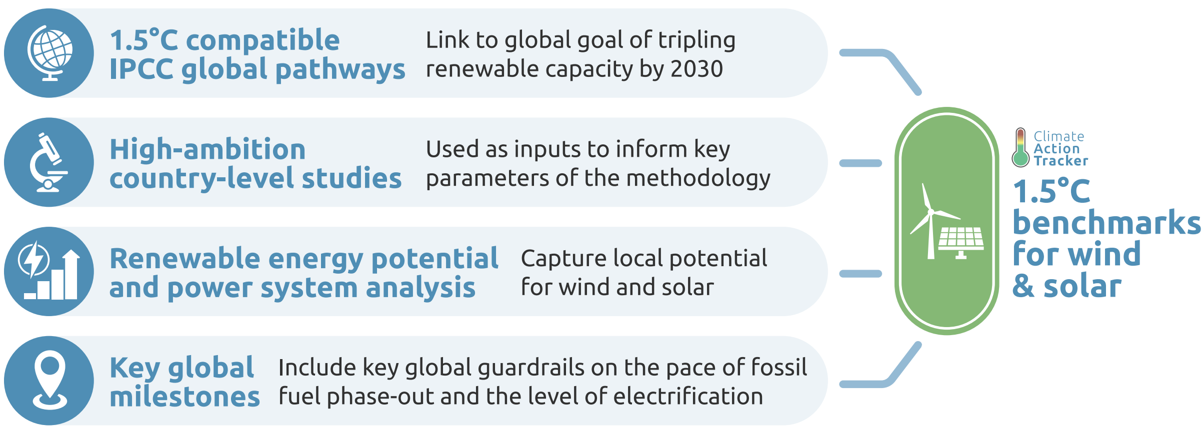
Summary of our method



Our method takes a series of steps to calculate the wind and solar generation needed for 1.5°C, and the resulting capacity deployment. The key methodological steps are highlighted below.

1. We project future electricity demand in the country.
2. We calculate the pace of fossil fuel phase-out needed to align with 1.5°C.
3. Bringing these trajectories together defines the level of clean electricity generation required to meet electricity demand growth while phasing out fossil fuels in the power sector.
4. We project non-wind and solar clean electricity generation based on country-level literature. This allows us to identify the wind and solar generation necessary to align with 1.5°C.
5. Having produced this wind and solar generation trajectory, we feed it into a simplified electricity system model (PyPSA), which calculates for a given set of cost assumptions around wind and solar, a split into wind versus solar and the associated capacity requirements.

Overlap of different elements



Our method focuses on the overlap between different elements. By looking at the range of fossil fuel phase-out which is outlined in both high ambition country-level studies and downscaled 1.5°Ccompatible global pathways, and is informed by key global milestones, we identify benchmarks which are both consistent with a global least cost pathway to limiting warming to 1.5°C but are also aligned with national–level modelling.

Combining multiple different analytical elements can help identify the most robust path to achieving a zero-carbon energy system.

For more details see the Methods Annex.

List of scenarios selected

Table 4: Country level studies for Australia

Study	Publication	Scenario selected
Aboumahboub et al., 2020	Decarbonization of Australia's energy system: Integrated modeling of the transformation of electricity, transportation, and industrial sectors	P1.5C
University of Melbourne, 2021	Net Zero Australia	E+
University of Melbourne, 2021	Net Zero Australia	E+RE+
Climateworks Centre, 2023	Climateworks Centre decarbonisation scenarios 2023: Australia can still meet the Paris Agreement	1.5 °C
Teske et al., 2023	Net-zero 1.5°C sectorial pathways for G20 countries: energy and emissions data to inform science-based decarbonization targets	1.5 °C

Annex A

Phases of grid integration

The grid integration phase is adapted from a de Vivero et al. report detailing a qualitative assessment framework for power system transformation and an IEA report on integrating solar and wind. We use the share of VRE sources in electricity generation to classify countries into a phase. More information about the characteristics and key challenges of each phase can be found in the report.

Phase 0 (less than 5% annual VRE share): we assign this phase when wind and solar make up 0-5% of a country's electricity generation mix. Installed VRE capacity is limited, and the impact on power system operation is negligible. Integration does not require significant operational or structural changes.

Phase A (between 5% and 15% annual VRE share): we assign this phase when wind and solar make up 5-15% of a country's electricity generation mix. Conventional power system operation remains largely sufficient for day-to-day system management. However, system planning must anticipate higher future VRE shares. This includes improving forecasting tools, integrating forecasting into dispatch decisions and moving toward shorter scheduling intervals and more real-time system operation.

Phase B (between 15% and 25% of annual VRE share): we assign this phase when wind and solar make up 15-25% of a country's electricity generation mix. The contribution of VRE varies significantly over time, with periods of very low output and periods of high penetration. This variability increases the need for operational flexibility. Enhanced coordination between system operators, network operators, and distribution system operators becomes critical to maintain system efficiency and security.

Phase C (between 25% and 40% of annual VRE share): we assign this phase when wind and solar make up 25-45% of a country's electricity generation mix. Periods in which VRE dominates system behaviour become increasingly frequent. A key operational challenge is maintaining system stability during sudden disruptions in supply or demand. Curtailment of VRE may become necessary to preserve system security. Without structural adjustments, integration constraints of VRE into the system may slow further increases in renewable energy shares despite additional installed capacity.

Phase D (between 40% and 70% of annual VRE share): we assign this phase when wind and solar make up 45-80% of a country's electricity generation mix. Periods in which VRE availability exceeds demand occur more frequently than in earlier phases. Ensuring system stability while continuing to increase renewable penetration requires additional measures, such as expanded demand response, stronger interconnections and large-scale energy storage. Market design and regulatory frameworks become increasingly important to enable these solutions. Although particularly critical in this phase, many of these measures should begin in earlier phases (B and C) to provide long-term investment signals and facilitate a smoother system transformation.

Phase E (more than 70% share of annual VRE share): we assign this phase when wind and solar make up 80-100% of a country's electricity generation mix. The power system reaches very high VRE penetration. The primary challenge becomes ensuring adequacy during extended periods of low wind and solar availability. Addressing this requires long-duration energy storage, sector coupling allowing for export and import of power between economic sectors in the same country and extensive electricity trade both within regions and between countries.

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The Consortium

The Climate Action Tracker (CAT) is an independent scientific analysis produced by three research organisations tracking climate action since 2009. We track progress towards the globally agreed aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C.

climateactiontracker.org

Climate Analytics is a non-profit institute leading research on climate science and policy in relation to the 1.5°Climit in the Paris Agreement. It has offices in Germany, the United States, Togo, Australia, Nepal and Trinidad and Tobago.

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NewClimate Institute is an independent non-profit organisation that develops solutions to tackle climate change and drives their implementation worldwide. Through research, policy advice and knowledge sharing, we aim to raise the ambition for climate action and support sustainable development.

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