

# **ELECTRIC SHOCK!** AUSTRALIA'S LIGHT-BULB MOMENT

CLIMATECOUNCIL.ORG.AU

# Thank you for making an impact.

The Climate Council is 100% independent and community-funded. We rely on word-of-mouth and donations from the general public to provide reliable and quality research, socialise it and then campaign for the solutions we need. If you'd like to support more reports like this go to: <u>www.climatecouncil.org.au/donate</u>

Published by the Climate Council of Australia Limited.

ISBN: 978-1-923329-11-9 (print) 978-1-923329-10-2 (ebook)

© Climate Council of Australia Ltd 2025.

This work is copyright the Climate Council of Australia Ltd. All material contained in this work is copyright the Climate Council of Australia Ltd except where a third party source is indicated.

Climate Council of Australia Ltd copyright material is licensed under the Creative Commons Attribution 3.0 Australia License. To view a copy of this license visit <u>creativecommons.org.au</u>.

You are free to copy, communicate and adapt the Climate Council of Australia Ltd copyright material so long as you attribute the Climate Council of Australia Ltd and the authors in the following manner: Electric Shock! Australia's Light-bulb Moment.

#### **Reviewers**:

We are very grateful to the following reviewers for generously sharing their time and expertise:

Greg Bourne - Climate Council Councillor

Responsibility for the final content of the report remains with the authors.



The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders, past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to land, sea and sky. We acknowledge the ongoing leadership of First Nations people here and worldwide in protecting Country, and securing a safe and liveable climate for us all.



Annika Dean Senior Researcher



Danielle Veldre Director CMC



Ben McLeod Quantitative Analyst





instagram.com/theclimatecouncil

tiktok.com/@theclimatecouncil



linkedin.com/company/climate-council

info@climatecouncil.org.au



facebook.com/climatecouncil





x.com/climatecouncil



climatecouncil.org.au

# Contents

| Ke | y findings   | i  |
|----|--|----|
| 1. | Introduction   | 1  |
| 2. | Australians love renewables, but are unfamiliar with all the types                   | 3  |
|    | When it comes to power – most Australians prefer renewable                           | 3  |
|    | Renewable power is more diverse and developed than most Australians realise          | 4  |
|    | Renewable power has a long and proud history in Australia                            | 9  |
|    | Energy storage is already here, and working in Australia                             | 11 |
| 3. | Our electricity system is rapidly changing, and it's hard for Australians to keep up | 16 |
|    | Coal is on the way out   | 16 |
|    | Australia will be powered by 82% renewables under the government's plan              | 19 |
|    | Our energy transformation is well underway   | 20 |
|    | There is a lot more renewable power on the way                                       | 23 |
|    | How does Australia rank against the rest of the world when it comes to renewables?   | 24 |
|    | <ul> <li>Total percentage of renewable electricity</li> </ul>                        | 26 |
|    | – Renewable power requires a relatively small amount of land                         | 27 |
| 4. | Renewables are delivering lots of benefits for Australians                           | 30 |
|    | Renewable power creates lots of jobs   | 30 |
|    | Renewables are our lowest-cost option for new electricity                            | 33 |
|    | Renewables are cutting climate pollution   | 36 |
| 5. | Conclusion   |    |
| Re | ferences   |    |
| Im | age credits  |    |
| Ap | pendix   | 40 |

# Key findings

#### 1 The Australian love affair with solar shows no sign of waning, with strong support for renewable power consistently recorded across our cities and regions.

- > Two-thirds (67%) of Australians whether living in cities or rural areas – support of renewable power projects, including within their own communities.
- Media coverage has disproportionately focused on the limited opposition toward renewables, and little on its significant support, which has led to Australians believing that community support for renewables is lower than it actually is.
- Australians are being harmed by worsening extreme weather driven by climate pollution that's overheating our planet and most of us (69%) remain concerned about climate change as cost of living pressures hit home.
- While two-thirds of Australians realise rooftop solar is a renewable power source, almost half fail to recognise wind, utility scale solar and hydro are also renewable energy sources.

# 2 Renewable power and storage is being built faster than most Australians realise, as we break world records on rooftop solar and big batteries.

- > Fewer than one in three Aussies think our country is doing better than others, when in fact we're the world leader in solar uptake per capita.
- We are also streaking ahead when it comes to storage. The Waratah Super Battery being built in New South Wales will be one of the most powerful batteries in the world when it's finished in 2025.

- > There are already more than a quarter of a million batteries storage systems providing renewable power to Australians around the clock, which 40% of Australians aren't aware of.
- More than 100 wind farms and more than 100 solar farms are operating across Australia yet 43% of Australians are not aware of *any* renewable energy projects in their state or region.
- Half of Australians don't realise we're already using big batteries to store renewable energy when it's abundant, and use it whenever we need it most – when 36 big batteries are already up and running.

# **3** Most Australians are unaware that coal is rapidly on the way out and needs to be replaced by renewable power and storage.

- > Since 2012, 15 coal-fired power stations in Australia have closed, or been partially retired.
- Australia's Energy Market Operator expects all our remaining coal-fired generators to close by 2038 but most Australians either overestimate or underestimate this timeline.
- > We need to replace this aging coal capacity with more renewable energy and storage before the lights go out, and our kids' future goes up in smoke.
- > Half of all voting Australians underestimate how much electricity we'll be generating from renewable energy by 2030 under the federal government's own plan: 82%.
- > There are around 223 projects amounting to 45GW of new utility scale storage and generation progressing through the connection process from application to commissioning. This is equivalent to about twice the capacity of Australia's current coal generators.



4 With some of the best solar and wind resources in the world, Australia has enormous potential for renewable power generation with wide-ranging economic benefits.

- > Benefits of renewable power are wide ranging from reducing climate pollution – by almost a quarter since 2005 – to reducing power bills. Having rooftop solar backed up by batteries leads to an average annual saving of \$1,500 for households.
- > Altogether, industries associated with clean energy and the transition to net zero are likely to generate around 1.2 million jobs to 2050.

 Renewable power projects can happily coexist with farming and improve biodiversity when done well, as well as providing benefits for communities. They also use far less land than most people realise.

- Research shows we can supply all of Australia's domestic energy needs with renewables, and that would directly use 1,200 square kilometres of land – equivalent to just 0.02% of our land mass.
- Properties hosting wind turbines and solar panels can still be used for pastoral grazing and other forms of agriculture, with large amounts of open space left around renewables. This is already occurring across Australia.
- > Unaware that many farmers and their regional neighbours are already happily hosting renewable energy infrastructure, Australians are at risk of falling for some big furphies about the support for renewable power in the regions.



Image 1: The students at Bronte Public school in Sydney's east benefit from solar panels on their school buildings.

# 1. Introduction

Australians are proud of our natural resources – and our renewable power achievements are no exception. Renewables like rooftop solar, gridscale wind and solar, and advanced storage now provide around 40% of the electricity in our main grid. The catch? Fewer than 1 in 10 Australians know it. That's no surprise – our energy system is transforming at lightning speed. Renewable electricity generation has quadrupled in the past decade and is set to double in the next. Yet polling reveals many Aussies don't realise grid-scale renewable projects have been powering us for a century, from the first hydro project completed in 1916 to the first solar and wind projects in the 1980s.

The challenge is visibility: when you flick on a light, it's impossible to tell where that power comes from.

The Climate Council commissioned research to find out just how much Aussies know about the progress we've already made on climate action and the switch to renewable power and found a significant gap between what's happening in the real world, and what people *believe* is happening.

This disconnect between perception and reality leaves space for misinformation to thrive.

But Australians are eager to learn – 81% want more information about how our energy system is changing. Just as fast as renewables are growing, so too is the flood of mixed messages. It's time to bridge the gap, empower Australians with the truth, and illuminate the path to a clean energy future.





Image 2: Tweed Shire Council's Bray Park Water Pump Station solar array, NSW.

Renewable electricity generation has quadrupled in the past decade, and is set to double in the next. 2.

# Australians love renewables, but are unfamiliar with all the types

#### WHEN IT COMES TO POWER – MOST AUSTRALIANS PREFER RENEWABLE

Australians are being harmed by climate change, caused by polluting coal, oil and gas, with serious consequences we're already living with. And a clear majority of Australians want climate action. Seven in ten Australians (69%) are concerned about climate change (in 2024) – despite cost of living pressures hitting hard (TAI 2024). This is just shy of 71% concern recorded in 2023. Among younger Australians (aged 18-24) concern about climate change is even higher, at 83% (TAI 2024).

Australians also love renewable power. A recent report by Porter Novelli found that two-thirds (67 per cent) of Australians – whether living in cities or rural areas

- are supportive of renewable power

projects, including initiatives in their own communities (Porter Novelli 2024). Yet narratives of regional opposition to renewables have taken hold in the media and in public discourse, leading many Australians to believe that support for renewables is much lower than this – at only 49% (Porter Novelli 2024). This significant gap between perceptions and reality highlights the power of disinformation in distorting the true views of Australians.

So, despite support for renewables in general, and particularly strong support for rooftop solar, there are many other types of renewable energy that Australians are less familiar with.

Narratives of regional opposition to renewables have taken hold in the media and in public discourse, leading many Australians to believe that support for renewables is much lower.

#### **RENEWABLE POWER IS MORE DIVERSE AND DEVELOPED** THAN MOST AUSTRALIANS REALISE

Even though general support for renewable energy is strong – 43% of Australians are unaware of any renewable power projects in their state or region (Porter Novelli 2024). This shows that most Australians have very low levels of awareness about renewable energy and the energy transition. But the good news is that Australians are interested in the energy transition, and want to know more.

A large study from CSIRO on the attitudes of Australians to renewable energy and the energy transition found that people perceive that their levels of knowledge about most energy technologies is low. In general, Australians report having limited or moderate knowledge about the large-scale infrastructure that will be developed as part of the energy transition – but interest is high, with 81% of people being interested in the energy transition, and saying that they want to know more about how our energy system is changing (Poruschi et al. 2024).

Polling commissioned by the Climate Council for this report confirms that levels of awareness about renewables are low, with confusion over what constitutes renewable energy technologies.

#### THE PERCEPTION

**Two out of three Australians (65%)** realise that **rooftop solar** is a renewable source of power, but fewer realise **large-scale solar (56%)**, **onshore / offshore wind (56%)** and **hydropower (55%)** are too.

Few Australians realise concentrated **solar thermal (38%)**, **green hydrogen (34%)** and **bioenergy (27%)** are forms of renewable power already used in Australia.

**One in four Australians mistakenly think nuclear is renewable (24%)**, and a small number think **polluting gas (17%)** and **coal (12%)** are. **Misinformed perceptions of nuclear energy** are more common among **older people (aged 55 and over) (31%)** and **Coalition voters (36%**).

#### THE REALITY - WHAT IS RENEWABLE POWER?

**Renewable power is "energy that comes from natural sources that are replenished faster than they are used" (United Nations 2024).** For example, sunlight and wind are sources of energy that are constantly being replenished. This is in contrast to fossil fuels, which take hundreds of millions of years to form, and are therefore more or less finite. There are lots of different types of renewable power. Some of the most common types of renewable power are solar power, wind power, geothermal, hydropower and bioenergy.



Solar power is the conversion of sunlight into usable forms. There are many different types of solar power, including solar photovoltaics (PV), concentrated solar thermal power, and solar heating (e.g. solar hot water). Because solar photovoltaic panels are a modular technology, they can be deployed in small quantities, as in rooftop solar, or they can be deployed in utility-scale solar farms.

Solar PV costs have fallen by around 90% in the past decade, and new solar PV is now far cheaper than fossil fuels in Australia, and most countries around the world (Ritchie 2024). Already, global solar PV generation is one of the most abundant forms of energy generation on earth. Annual generation from solar PV exceeds 1000 TWh per year, and growth is expected to continue. According to forecasts from the International Energy Agency, solar PV capacity is expected to surpass coal and gas fired generation by 2035, to become the main source of electricity globally (IEA 2024).

In Australia, uptake of rooftop solar has been the highest of all solar technologies, with installed capacity at around 25GW (Clean Energy Council 2024). This is followed by utility-scale solar. Uptake in concentrated solar thermal power, both in Australia and globally, has been much slower than solar PV, due to its higher cost. The benefit of concentrated solar thermal power – despite being more expensive – is that it can offer storage of up to 15 hours (ARENA 2024). Australia's first commercial concentrated solar thermal power plant is under construction in Port Augusta, South Australia and is scheduled to be commissioned in late 2025. It is a 30 MW / 288 MWh project.



Image 3: Solar farm installation in Kidston, Queensland.

### Wind power

Wind power is energy generated by harnessing the wind. The two main types of wind power are onshore wind, and offshore wind. Onshore wind is a mature technology with an established global supply chain. Because wind blows during the day and night, wind power is very complementary to solar, and is therefore important as part of the energy mix for achieving net zero emissions in Australia. Around 13% of electricity in our main grid came from wind last year – higher than any other single contribution from renewables (Open Electricity 2024b).

The offshore wind industry in Australia is still in early stages of development – but is already well established in other places such as the United Kingdom, where around 17% of energy generated comes from offshore wind (The Crown Estate 2023). Offshore wind in Australia has huge potential as Australia's offshore wind resources are among the best in the world – up there with the North Sea between Britain and Europe, which is the world's leading offshore wind region (Briggs et al. 2021). Australia has technically accessible<sup>1</sup> wind potential just off our shores of around 2,233 GW, which is enough to power our entire electricity grid several times over (Briggs et al. 2021).

Offshore wind is a highly reliable and efficient form of renewable power. A single offshore wind turbine can generate 66 GWh of electricity per year - enough to power 10,000 Australian households. In fact, a single rotation of an offshore wind turbine can generate enough energy to power a household for 24 hours (DCCEEW 2024a). In late 2022, Gippsland was declared Australia's first offshore wind zone, and Star of the South – a 2.2 GW wind farm in this offshore wind zone – is expected to begin generating electricity before 2030. Once it is operating, it is expected to generate enough electricity to power 1.2 million households each year, and add \$8 billion to the Australian economy over its lifetime (Southerly Ten 2024).

Image 4: Dimity Taylor's family ride on their Crookwell property which hosts a wind farm.



<sup>1</sup> The technically accessible wind resource included areas that are less than 100 km from shore, in water depths of less than 1000m, within 100 km of sub-stations and transmission lines and excluding environmentally restricted areas.

### Hydropower

Hydropower is generated when falling water – either from dams or flowing water from rivers, streams or waterfalls – is channeled through water turbines, causing them to rotate. The rotating shaft drives a generator, which converts the motion of the shaft into electrical energy. Hydropower is the oldest form of renewable electricity, and is used in more than 160 countries worldwide (IHA 2024). It can be generated on demand, and can increase its generation quickly, making it highly complementary to other sources of renewable power.

Australia has 59 hydroelectric power stations, with installed capacity of around 10,355 megawatts (MW) (Open Electricity 2024a). These are located in the areas with highest elevation and rainfall, and are mostly in New South Wales and Tasmania. The Snowy Mountains Hydro-electric scheme – with a capacity of 4,100 MW, is Australia's largest hydro scheme. Hydroenergy is also particularly important in Tasmania, where it provides much of the state's electricity. Some of this hydroelectricity is exported to the Australian network through an undersea interconnector which runs under the Bass Strait. There are also smaller hydroelectric schemes in north-east Victoria, Queensland, Western Australia and South Australia.

In Australia, the forms of renewable power we currently use are rooftop solar, utility solar, onshore wind energy, hydropower and bioenergy (both biomass and biogas). Forms of renewable energy that are under development are concentrated solar thermal and offshore wind. Geothermal has some potential applications on a small scale for renewable heat in manufacturing, but, although Australia has significant geothermal potential, it is not currently financially viable in our electricity system.



Image 5: Hydro electric dam in Kidston, Queensland.

Table 1: The main renewable energy technologies in operation in Australia (December 2024).

| Technology       | Number of facilities | Capacity | % total generation (2023)        |
|------------------|----------------------|----------|----------------------------------|
| Solar (utility)  | 102                  | 9,709MW  | ~ 7% (14,604 GWh)                |
| Solar (rooftop)  | ~4 million           | 25,000MW | ~ 11.1% (23,160 GWh <sub>)</sub> |
| Wind (onshore)   | 111                  | 14,741MW | ~ 13.2% (27,643 GWh)             |
| Hydroelectricity | 59                   | 10,355MW | ~ 7.3% (15,287 GWh)              |

Source: OpenElectricity (2024a, 2024b).

Hydropower is the oldest form of renewable electricity... It can be generated on demand, and can increase its generation quickly, making it highly complementary to other sources of renewable energy.

#### **RENEWABLE POWER HAS A LONG AND PROUD HISTORY IN AUSTRALIA**

Renewable power has a long history in Australia that dates back more than half a century. The first large-scale renewable energy project in Australia was the Waddamana Hydro-Electric power station in Tasmania opened in 1916 and the first wind farm and solar farm were both built in the 1980s. But, according to our own polling, few Australians realise that solar and wind have been around for this long in Australia.



Image 6: Waddamana Power Station in Tasmania was the first hydropower station to supply Hobart.

#### THE PERCEPTION

<u>بې</u> ۲۲۲ ۱ When asked how long ago Australia built its first solar farm, 38% of people were unsure and 55% thought it was more recent than the 1980s. Only 6% of people correctly chose the 1980s.

When asked how long ago Australia built its first wind farm, 37% of people were unsure and 49% thought it was more recent than the 1980s. Only 14% correctly chose the 1980s.

#### THE REALITY - A HISTORY OF RENEWABLE POWER IN AUSTRALIA

| 1898 | Australia's first hydro-electric project opens, using pressurised water from a bore to power streetlights.  |
|------|---|
| 1916 | <b>The first major renewable energy project in Australia</b> , Waddamana hydro-electric power station, opens, at first powering 300 homes.  |
| 1955 | <b>Two major hydro-electric plants (Guthega and Blowering) open</b> in NSW as part of the Snowy Hydro scheme.   |
| 1974 | Tumut 3, Australia's first pumped hydro project opens in NSW.   |
| 1981 | <b>First solar farm built in Australia</b> – White Cliffs Solar Power Station – located in New South Wales. The farm used concentrated solar heat to boil water and generate electricity from the resulting steam.  |
| 1987 | <b>First wind farm built in Australia</b> – The Salmon Beach Wind Farm near Esperance in Western Australia – had six turbines that operated for nearly 15 years. The asset was decommissioned in 2002 due to the age of the turbines and larger, more cost-effective units that had since become available.   |
| 1989 | <b>First solar photovoltaic</b> (i.e. converting light directly to electricity) plant is commissioned to provide power to Wilpena Pound in South Australia.   |
| 2001 | <b>The Australian government introduced the Renewable Energy Target (RET)</b> to ensure that 20% of Australia's electricity comes from renewable sources by 2020. The RET has been one of Australia's most effective climate initiatives, leading to an additional 40GW of solar and wind capacity over time (equivalent to around 20 Liddell power stations).      |
| 2007 | First mainstream solar rebates offered in Australia and state 'feed in tariffs' introduced.   |
| 2011 | <b>First commercial scale solar PV farm</b> – Uterne – a 1 MW solar plant in Alice Springs, followed closely by Greenough River solar farm near Geraldton in Western Australia (10 MW), which opened in 2012.   |
| 2012 | Rooftop solar starts to take off in Australia.  |
| 2017 | <b>First big battery installed in Australia</b> – The Hornsdale Power Reserve in South Australia – was the largest lithium-ion battery in the world at the time of installation – at 129 MWh and 100 MW. (It was expanded in 2020 to 194 MWh at 150 MW. Despite the expansion, it lost that title in August 2020 to the Gateway Energy Storage in California, USA). |
| 2023 | Close to 40% of electricity in the National Electricity Market is generated from renewable energy.  |

#### **ENERGY STORAGE IS ALREADY HERE, AND WORKING IN AUSTRALIA**

Storage means we can soak up solar, and wind power when it's abundant and use it whenever we need. Having a diverse mix of renewable power, backed by storage, is critical for energy reliability. Our polling indicates that Australians' awareness of what storage technologies are available, and how they are used in Australia, is limited.

#### **THE PERCEPTION**

40% of Australians don't realise we're already using household batteries to store rooftop solar, with more than 250,000 home battery systems installed around the country.

**52% aren't aware we're already using big battery storage** with more than 22 projects of 10 MW or 10MWh in use around the country – and many more in the pipeline.



Most Australians (62%) haven't heard of, or are unfamiliar with solar thermal.

م بري 2 Most Australians haven't heard of, or are unfamiliar with, **pumped hydro (65%**) which has been in use in Australia since 1973.

15% of Australians polled didn't know we used any of these forms of renewable energy storage.

#### THE REALITY - WHAT IS ENERGY STORAGE?



Energy storage technologies work to store electrical energy that's produced from renewable sources. The main types of storage are:



Pumped hydroelectricity



Thermal storage



Battery storage Lithium ion and flow batteries



Hydrogen

#### ٥ كري Pumped hydroelectricity

Pumped hydro stores power in the form of the gravitational potential energy of water. When demand for electricity from the grid is low and supply is plentiful, water can be pumped uphill to an elevated dam. When demand from the grid is high, the water is released to flow through turbines and create hydroelectric energy. Pumped hydro effectively functions like a giant water battery.

Australia has three operational pumped hydro projects, with a combined capacity of around 1.6 GW. These are Wivenhoe, Tumut 3 and Shoalhaven – all built between 1973 and 1983. There are currently two projects under construction: The Kidston project in Queensland – expected to begin operation imminently — will add an extra 250 MW of pumped hydro capacity, and Snowy 2.0 will add an additional 2GW once operational (GE Renewable Energy 2020). Another project – the Borumba pumped hydro project in Queensland – is still at the proposal stage. Australia has a lot more potential for small to medium scale pumped hydro – as shown in a pumped storage 'atlas' published by the Australian National University with support from the Australian Renewable Energy Agency – which identifies hundreds of potential pumped storage sites (Blakers et al. 2017).



Image 7: Simon Tickner and wife Susan Findlay-Tickner on their farm in the Grampians, Victoria which hosts wind turbines.

### $\begin{bmatrix} + \\ - \\ - \end{bmatrix}$ Batteries

Batteries are another form of energy storage. Batteries use chemical reactions to absorb surplus energy, and release it when it is needed. Batteries are a highly flexible source of storage – they are able to react very quickly – in fractions of a second – to dispatch energy on demand. Another benefit of batteries is that they can be installed in various quantities and settings. Large-scale batteries can store significant amounts of power. Smaller batteries can be used in homes, and can also be connected to work in harmony with other small batteries in a system called a virtual power plant (VPP).

Australia is a global leader when it comes to big battery technology. The Hornsale Power Reserve in South Australia, built in 2017, was the biggest battery in the world at the time it was built - at 100 MW/129 MWh. Since then, battery technology has continued to evolve rapidly in Australia. In late 2023, federal approval was given for the largest battery in Asia, and one of the largest in the world at the time, to be built as part of the Melbourne Renewable Energy Hub. When fully developed, the Melbourne Renewable Energy Hub will be a 1.2 GW/2.4GWh Battery Energy Storage System - enough capacity to power more than 1 million households for four hours (Equis 2024). The project is being developed in two phases, with the first phase currently under construction and scheduled to begin operation in 2025. Phase 1 will have storage capacity of 600MW/1600MWh.

The Waratah Super Battery in New South Wales – also under construction currently and scheduled for completion in 2025 – will be one of the biggest battery energy storage systems in the southern hemisphere. The 850 MW/1.68 GWh system will act as a "shock absorber" for the grid in the event of power surges, allowing poles and wires to be used more safely at their full potential (Akaysha Energy 2024). Installed big battery storage in Australia is around 1.7GW today – but there is 7.8 GW under construction and Bloomberg New Energy Finance predicts there will be 18.5 GW of big battery storage by 2035 (PV Magazine 2024).

Household batteries have also taken off in Australia, with around 250,000 households having installed a battery between 2015 and 2023 – bringing the combined capacity of household batteries to around 2,770 MWh (SunWiz 2024). Household storage has a lot more potential. The Climate Council has identified an opportunity to install 2 million additional battery units on households and businesses and around 5,000 community batteries by 2030 (Climate Council 2024a).

Australia is a global leader when it comes to big battery technology.



Image 8: The Watson household play outside their electrified home.



Image 9: The Waratah Super Battery is designed to increase grid reliability in NSW.



**Figure 1:** Big battery technology and capacity is evolving rapidly in Australia – with the size of new batteries under construction and proposed many times more than what is currently in operation.

3.

# Our electricity system is rapidly changing, and it's hard for Australians to keep up

#### **COAL IS ON THE WAY OUT**

For a long time in Australia, coal was at the foundation of our energy system. But Australia's coal fired-power stations are now getting old, and are increasingly unreliable. Australia's coal-fired power stations are also becoming more costly and difficult to maintain, and they are unable to compete with the growing share of renewable energy in the grid (AEMO 2024a). Since 2012, 15 coal fired power stations have been retired or partially retired (Open Electricity 2024a). Reliability risks were highlighted in June 2022 when 13% of the coal-fired generation capacity in the National Electricity Market was out of action (3 GW) (AEMO 2024a).

According to polling commissioned by the Climate Council, Australians think that our coal-fired power stations are likely to be around for a fair bit longer than the Australian Energy Market Operator predicts.



Image 10: Wallerawang Power Station operated from 1957 to 2014. Wallerawang, NSW, Australia.

| Closure                | Power station                       | State                         | Capacity |
|------------------------|-------------------------------------|-------------------------------|----------|
| 2012                   | Swanbank B                          | Queensland                    | 500MW    |
| 2012                   | Munmorah                            | New South Wales               | 600MW    |
| 2012                   | Collinsville                        | Queensland                    | 186MW    |
| 2014                   | Energy Brix                         | Victoria                      | 195MW    |
| 2014 (partial closure) | Kwinana                             | Western Australia             | 400MW    |
| 2014                   | Redbank                             | New South Wales               | 150MW    |
| 2014                   | Wallewarang                         | New South Wales               | 1,000MW  |
| 2015                   | Anglesea                            | Victoria                      | 165MW    |
| 2015                   | Callide A                           | Queensland                    | 120MW    |
| 2016                   | Northern                            | South Australia               | 730MW    |
| 2016                   | Playford B                          | South Australia               | 480MW    |
| 2017                   | Hazelwood                           | Victoria                      | 1,640MW  |
| 2017                   | Muja AB                             | Western Australia             | 240MW    |
| 2022 (partial closure) | Muja CD (closure of Muja C, unit 5) | Western Australia             | 195MW    |
| 2023                   | Liddell                             | New South Wales               | 2,000MW  |
| Total facilities: 15   |                                     | Total retired capacity: 9,221 | MW       |

 Table 2: Timeline of coal power station closures across Australia.
 Source: Open Electricity 2024a.

#### **THE PERCEPTION**



38% of Australians polled have no idea when the Australian Energy Market Operator (AEMO) expects all coal-fired power stations to close: 2038.

Those polled either **overestimated or underestimated** this timeline with, **21% choosing by 2035 and 17% choosing by 2050**.

#### THE REALITY - COAL IS ON THE WAY OUT



**Coal is on the way out,** and we need a plan to add more renewables, quickly. The latest Integrated System Plan (2024) from the Australian Energy Market Operator forecasts all our remaining coal-fired generators will close by 2038 (AEMO 2024a). This is earlier than the retirements that have been announced, as shown in Figure 2 below, and is being driven by a commercial reality: **coal cannot compete with low-cost renewable power**.



#### PROJECTED DECLINE OF COAL CAPACITY IN THE NATIONAL MARKET

**Figure 2:** Coal capacity in the National Electricity Market has declined rapidly since around 2009, and the Australian Energy Market Operator expects that all coal fired power stations will be closed by 2038.

### AUSTRALIA WILL BE POWERED BY 82% RENEWABLES UNDER THE GOVERNMENT'S PLAN

The fact that Australia's coal-fire power stations are likely to be closed as early as 2038 – much earlier than the announced retirements – makes it all the more important that we have a plan to add more renewable energy to the grid – and quickly. Most Australians are probably aware that the federal government has an overall goal to reach net zero by 2050 – but according to the polling commissioned by the Climate Council – most don't realise that the government has a plan for the grid to be powered by 82% renewable energy by 2030.

While this is the right direction, we know that Australia should be doing much more than this to cut our emissions. Based on our capability and responsibility, Australia should be aiming for 75% emissions reductions below 2005 levels by 2030. We also know that achieving this level of emissions reductions would be technically possible, if backed by the political will (Climate Council 2024). To achieve this target, Australia would need to expand our main grid capacity by 2030, from around 108GW today to 222GW. Expanding our grid is necessary to underpin a clean, electrified economy and accommodate increased electricity consumption from cutting fossil fuels in transport, industry and households. Doing so would see around 94% of our electricity generated from renewables by 2030. Around 24GW of additional capacity could come from rooftop solar, with another 24GW coming from household and community batteries. We will also need around 48GW of additional utility-scale capacity, with the majority of this coming from wind (Climate Council 2024b).

#### **THE PERCEPTION**

?

**41%** of participants are **unsure how much of our electricity will be generated by renewable energy sources by 2030**.

Another **48% underestimated how much electricity we'll be generating from renewable energy by 2030** under the federal government's plan.

#### THE REALITY - RENEWABLE POWER WILL MAKE UP AT LEAST 82% BY 2030

ц. П. П.

The federal government's renewable energy target is 82% by 2030. This target is the modelled outcome of the federal government's Powering Australia Plan, which includes its Rewiring the Nation policy. The plan is designed to boost renewable energy to put Australia on track to reach its emissions reduction target of 43% below 2005 levels by 2030. The plan is also expected to generate 604,000 jobs, and drive \$76 billion in total investment (Reputex 2021).

#### **OUR ENERGY TRANSFORMATION IS WELL UNDERWAY**

The good news is Australia's energy transition is already well underway, and we are building renewable power projects faster than most Australians realise! In 2023, renewables accounted for almost 40% of generation in the National Electricity Market. According to polling conducted by Essential Research, most Australians don't realise we already have this much renewable energy in our grid (Essential Research 2024a).

#### **THE PERCEPTION**

Fewer than **one in 10 Australians realise** how much of our main **electricity grid is already powered by renewables, backed by storage.** 



57% think we are producing less electricity from renewables like solar and wind than we actually are.

Only 8% of Australians realise that about 40% of our electricity comes from renewable energy, 11% thought it was higher and 20% didn't know.

#### THE REALITY – OUR POWER TRANSFORMATION IS WELL UNDER WAY



Close to 40% of electricity in the National Electricity Market came from renewables in 2023 (38.6% over the whole year, or 40.8% in the second half of the year) (Open Electricity 2024b). This is a remarkable achievement given only 15.6% of generation came from renewables in 2017 (when large-scale investment in renewables really kicked off) (Open Electricity 2024b).

Based on our capability and responsibility, Australia should be aiming for 75% emissions reductions below 2005 levels by 2030. The renewable generation profile in 2023 was made up of rooftop solar (11%), utility solar (7%), wind (13.2%), hydro (7.3%) and biomass (0.1%) (Open Electricity 2024b). Wind and pumped hydropower (with small contribution from batteries) are already contributing to an estimated 30% of our overnight electricity generation.<sup>2</sup> The amount of renewable generation in our grid is expected to ramp up rapidly over the next 10 years, under the most likely scenario set out by the Australian Energy Market Operator (see Figure 3).



#### AUSTRALIA'S CURRENT PLAN TO INCREASE RENEWABLE POWER IN OUR MAIN GRID

Figure 3: The transition to renewable energy is already well underway. Source: AEMO 2024a.

<sup>2</sup> Open Electricity only allows calculation of the overnight contribution from renewables for the current week. Between 18-25th October, 29.9% of electricity from 7pm-7am came from renewables.

There are now more than 100 utility-scale solar farms in Australia, with a combined capacity of 9,709MW (9.7GW – equivalent to around 3.5 Eraring power stations<sup>3</sup>) and more than 100 wind farms, with a combined capacity of 14,741MW (14.7GW – equivalent to around five Eraring power stations) (see Figure 4) (Open Electricity 2024a). There are four million households with rooftop solar, with an estimated combined capacity of around 20,000MW (25GW – equivalent to almost nine Eraring power stations), and around 1 in 16 of these homes have batteries.



**Figure 4:** Utility-scale renewables map of Australia – Australia has more than 100 utility scale solar plants (orange), more than 100 wind farms (green), almost 60 hydroelectricity plants (light blue), three of which have pumped hydro capability, and 34 big batteries (purple). **Source:** Open Electricity (2024a).

<sup>3</sup> This calculation is based on capacity; However, note that the actual generation of a facility depends on the capacity factor – how often the facility is generating electricity over a year. This differs between energy types and facilities.

#### THERE IS A LOT MORE RENEWABLE POWER ON THE WAY

There is a lot more renewable energy and storage in the pipeline. 2024 is shaping up to be a record-breaking year for renewables deployment. Between 7.2-7.5GW of new gridscale wind and solar capacity is expected to have been added in 2024, exceeding the previous record of 7.16 set in 2020 (Clean Energy Regulator 2024). A further 3 GW of rooftop solar capacity is also expected to have been added to Australian homes and businesses (Clean Energy Regulator 2024). In 2025, 45% of our main grid is expected to be powered by renewables (Grattan 2024). At the end of September 2024, around 223 projects amounting to 45GW of new utility-scale storage and generation were progressing through the National Electricity Market's connection process from application to commissioning (AEMO 2024b).



Image 11: Rooftop solar is just the beginning of the switch to renewable power as more grid-scale projects come online.

### HOW DOES AUSTRALIA RANK AGAINST THE REST OF THE WORLD WHEN IT COMES TO RENEWABLES?

When it comes to the Olympics we're used to punching well above our weight, with Australia regularly finishing within the top 10 of the medals tally. When it comes to rooftop solar, and solar in general, Australia is genuinely world leading. Many people, all over the world, hold us up as a great example of what's possible – but according to polling conducted by Essential Research (2024b) most Australians don't realise exactly how well Australia is doing compared to other countries.

#### **THE PERCEPTION**

Fewer than **one in three Australians (28%) think we're doing better than other developed countries** when it comes to **converting homes to renewable energy**.

One cour

One in five Australians (20%) think our country is doing worse than other developed countries.

#### THE REALITY - HOW AUSTRALIA RANKS



**On a per capita basis, Australia is a world leader when it comes to solar energy.** Australia had just over 1.1 kW (1,166W) of solar per person at the end of 2022, giving it first place on that metric ahead of the Netherlands and Germany (IEA PPSP 2023).

When it comes to rooftop solar, and solar in general, Australia is genuinely world leading. When you're measuring the total amount of solar, Australia comes in at number six around the world. That means we sit in the top 10 alongside countries with much larger populations and economies, like China, Germany, India and the United States (see Figure 5).



Figure 5: Australia is number one when it comes to solar PV per capita, and sits in the top ten for cumulative solar capacity – alongside countries with much larger populations and economies.

In terms of penetration, or the amount that solar accounts for as a percentage of our total electricity use, we're also near the top of the table with solar accounting for 15.7% of our electricity consumption in 2022. That puts us in fourth place behind Spain, Greece, Chile and Jordan (IEA PPSP 2023).

Most of Australia's solar is distributed, typically on rooftops, rather than utility scale. The total capacity of rooftop solar is now around 25 GW. In November 2024, Australia reached its four millionth rooftop solar installation (Clean Energy Council 2024). One in three Aussie households now have solar on their rooftops – making rooftop solar three times more common than the backyard pool (AEMO 2024a). Rooftop solar is now capable of meeting more than half of underlying demand<sup>4</sup> across the National Electricity Market in the middle of a sunny day (AEMO 2024a). In the summer of 2023-24, rooftop solar accounted for 13% of total generation, ahead of wind power (11.8%), utility solar (8.6%), hydro (5.3%) and gas (4.1%) (AEMO 2024a). Rooftop solar installations continue to grow: the growth in new rooftop solar systems has been averaging 12% year on year over the past five years (AEMO 2024a).

#### Total percentage of renewable electricity

When it comes to the total percentage of renewables in our grid, Australia is ranked at number 26 out of 38 OECD countries, based on 2022 data (IRENA 2024). Many of the countries with very high percentages of renewable electricity have large sources of hydropower, such as Iceland, Costa Rica and Norway. According to polling conducted by Essential Research (2024b) views about how Australia ranks relative to other countries are mixed.

#### **THE PERCEPTION**

One in four Australians (25%) think that Australia is doing better than other developed countries when it comes to building a renewable grid. 36% think that Australia is doing about the same as other developed countries, 21% think that Australia is doing worse than other developed countries, and 18% are unsure.

#### THE REALITY – AUSTRALIA'S RENEWABLE POTENTIAL IS THE ENVY OF THE WORLD

Australia could be much higher on the ranks for total percentage of renewable energy, considering the renewable potential that we have compared to other countries. Australia has the highest solar potential of any country on earth, some of the best wind potential, and a large landmass. Our renewable resources are so vast, that solar and wind on less than 2% of our land could power Australia 20 times over (Burke et al. 2022).

According to polling commissioned by the Climate Council, most Australians overestimate the amount of land required to significantly increase our current electricity generation from renewable sources.

<sup>4</sup> Underlying demand means all the electricity used by consumers, which can be sourced from the grid but also, increasingly, from other sources including consumers' rooftop photovoltaic (PV) and battery storage.

#### Renewable power requires a relatively small amount of land

All of Australia's renewable power needs can be met with a small proportion of the country's land. Much of the land required for solar and wind farms can also be used for other agricultural purposes like grazing.

#### **THE PERCEPTION**

More than 1 in 2 Australians (60%) overestimate the amount of total land required to generate over 20 times our annual electricity generation from solar and onshore wind (i.e. 2% or less).

Only 8% gave the correct answer of less than 2% and around a third (32%) were unsure.

#### THE REALITY - 0.02% OF OUR LANDMASS IS REQUIRED FOR ALL OUR POWER NEEDS



**Australia's renewable potential is unmatched**. Australia has the best solar resources in the world – particularly in Northern Australia. We also have some of the best wind resources in the world. Given this, Australia has potential to generate some of the cheapest electricity in the world using wind and solar technologies that are readily available.

Australia has potential to generate some of the cheapest electricity in the world using wind and solar technologies that are readily available. Building enough wind and solar to supply all of Australia's domestic energy needs including all transport, heating and industry which is currently fuelled by gas, petrol or diesel – would take up just 1,200 square kilometres of land – equivalent to around 0.02% of Australia's land (Blakers 2024). This calculation is based on the land directly alienated by renewables infrastructure, that is the direct footprint of solar panels and wind turbines. The area spanned would be about 15 times larger than this – or around 18,000 square kilometres - but most of this area would be suitable for continued agriculture like grazing cattle around wind turbines, or sheep under solar panels (Blakers 2024). This land area accounts for the need to generate around three times more electricity than we currently consume, in order to electrify transport, heating and industry.

Once we meet our own energy needs, Australia can also take advantage of our world-class wind and solar resources to export renewable energy to the world. Some of our best solar and wind resources are located in very close proximity to iron ore and bauxite deposits, making local processing a promising opportunity. Australia could also potentially export clean fuels such as green hydrogen, or directly export renewable energy via sub-sea cables.

Image 12: Sixth-generation western NSW wool farmer Tony Inder grazes sheep under solar panels.



# HOW MUCH SPACE DO RENEWABLES REALLY NEED?

Australia is on its way to becoming a renewable super power, with wind and solar farms generating clean electricity in every state and territory. The amount of land required to build renewable energy is a common misconception. The great news is, we don't actually need much space to power ourselves with renewables.



4.

# Renewables are delivering lots of benefits for Australians

#### **RENEWABLE POWER CREATES LOTS OF JOBS**

A rapid scale up of the energy workforce is needed to build the renewable power that is needed over the next few decades and transition the Australian economy to net zero. Under a scenario that is broadly aligned to current government climate and energy policy – where Australia reaches 82% renewables in the main national grid and net zero by 2050 – there will be a significant increase in jobs. According to polling conducted by Essential Research (2024c), many Australians mistakenly think declining industries like coal and gas can generate a lot of jobs, when the opposite is true.



**Image 13:** Industries associated with the transition to clean energy and a net zero economy are likely to generate around 1.2 million jobs to 2050.

#### **THE PERCEPTION**



**39% of Australians mistakenly think declining industries like coal and gas can generate a lot of jobs when the opposite is true:** jobs in these industries will decline as the economy decarbonises, and jobs in clean energy and associated supply chains will increase. Slightly fewer Australians polled (36%) think that renewable energy creates the most jobs.

#### **THE REALITY – RENEWABLE POWER CREATES JOBS**



A study looking at **the jobs that will be needed in the coming decades to support the transition to renewable power and the broader transition to net zero found that the clean energy supply and distribution sector (jobs directly involved in generating and distributing renewable energy) – is likely to grow by around 30,000 by 2050** (Jobs and Skills Australia 2023).

There are also lots of other industries that will play a role in the transition to clean energy and a decarbonised economy – clean energy jobs can be found right across the workforce, for example in areas such as research and construction. Altogether, industries associated with the transition to clean energy and a net zero economy are likely to generate around 1.2 million jobs to 2050 (Jobs and Skills Australia 2023b). This includes jobs in clean energy supply, clean energy demand, enabling industries and other industries involved in managing climate pollution (such as jobs in the circular economy) (see Table 3). Fossil fuel related industries, such as coal and gas, are likely to experience a decline in employment as the economy switches to clean energy (Jobs and Skills Australia 2023b). For example declines in employment in fossil fuel related sectors are expected to occur to 2030 of around 11,000 employees, as ageing coal fired power stations and associated coal mines close.

Declines in employment in fossil-fuel related sectors are expected to occur to 2030 of around 11,000 employees, as ageing coal fired power stations and associated coal mines close. **Table 3:** Modelled increase in jobs between 2023 and 2050 in the transition to net zero under a central scenario, which broadly aligns with current government climate and energy policy, and future policy intent.

| Sector   | Description  | Additional jobs from<br>2023 to 2050 |
|--|--|--------------------------------------|
| Clean energy supply                                    | The clean energy supply sector includes workers involved in generation, transmission and distribution of renewable energy. This sector currently employs around 53,000 Australians.  | 28,600                               |
| Clean energy demand                                    | The clean energy demand segment includes energy usage, energy<br>performance and clean transport. Energy usage covers installation<br>of small-scale rooftop solar, and electrification of heating and<br>cooling. Energy performance covers industries involved in<br>improving the energy efficiency of buildings.   | 524,500                              |
| Enabling industries                                    | There are also many clean energy enabling industries, which<br>are likely to see employment growth to facilitate the transition to<br>net zero. These industries include education, training, research<br>and technology; engineering, procurement and construction;<br>finance, legal and business; regulatory industries and vehicle and<br>equipment production, trade and maintenance. | 678,500                              |
| Carbon life cycle<br>industries                        | Carbon life cycle industries include those that make a substantial contribution to managing and reducing climate pollution, such as jobs in the circular economy.  | 10,900                               |
| Sub-total  | 1,242,500 (1.2 million)  |                                      |
| Transitioning and<br>emissions intensive<br>industries | Transitioning industries are fossil-fuel related groups which<br>will decline and transform during decarbonisation. Emissions-<br>intensive industries include heavy manufacturing (such as metals,<br>cement and chemicals manufacturing) and light manufacturing.  | -59,900                              |

**Note:** The numbers in this table are based on modelling conducted by Deloitte Access Economics for Jobs and Skills Australia (presented in Tables 2-4 in Jobs and Skills Australia (2023b)).

The numbers presented in the table above are based on industry categories. But the growth in jobs related to the clean energy transformation can also be presented in terms of occupations. There are 38 critical clean energy occupations that will experience higher growth rates than the broader workforce over the next 30 years. Demand for these occupations is likely to increase by 15% over the next seven years – representing an increase of around 240,000 workers. Occupations with the highest growth rates in the next seven years (2023-2030) include telecommunications trades workers, electronics trades workers, electrical engineering draftspersons and technicians, structural steel construction workers, construction managers, plumbers and electricians. The biggest shortage is likely to be for Electricians. Australia will likely need around 32,000 more electricians in the next seven years and 85,000 by 2050 (Jobs and Skills Australia 2023a).

#### **RENEWABLES ARE OUR LOWEST-COST OPTION FOR NEW ELECTRICITY**

Australians with solar on their rooftop already know it saves them money, but when it comes to powering our grid most of us still don't realise that renewable power backed by storage is the cheapest option around. With coal-fired power stations on the way out, we need a plan to add more solar, wind and storage as quickly as possible. According to polling conducted by Essential Research (2024d), Australians are confused about which source of power is the cheapest option we have.

#### **THE PERCEPTION**

While 38% of Australians correctly think that nuclear energy is the most expensive, 35% mistakenly think that renewable power is.

Another 27% think that fossil fuels such as coal, oil and gas are most expensive.

#### THE REALITY - RENEWABLES ARE THE LOWEST COST POWER OPTION



**Rooftop solar saves households money.** With rooftop solar alone, households can cut their energy bills by 39-57% per year – a saving of between \$822 and \$1,350. Homes with both rooftop solar and battery storage capacity of 8.5kWh can save between 75 and 100 percent on their energy bills – or between \$1,322 and \$2,252 – an average saving of \$1,500 per year (Vorrath 2023).

#### BENEFITS OF RESIDENTIAL ROOFTOP SOLAR WITH A 8.5KWH BATTERY BY JURISDICTION



Figure 6: In states such as New South Wales, Queensland and South Australia, rooftop solar combined with an 8.5kWh battery system can provide enough storage for a household to essentially eliminate their electricity bills. **Source:** Vorrath (2023) based on DCCEEW estimates.

Renewables can also have the effect of reducing wholesale electricity prices. This can happen through a few different mechanisms. For example, rooftop solar has the effect of reducing energy demand and increasing supply of electricity during the day. As a result, wholesale energy prices are lower during times when solar exports are high. Wholesale power prices are set through the "merit order", which is the sequence in which power stations contribute power to the market. The cheapest power, set by the power stations with the lowest running costs, sets the starting point. Since the marginal cost of renewable energy is almost zero, it is often the first to be dispatched, which reduces the need for more expensive fossil fuel generation. For example, the quarterly energy report from Australia's Energy Market Operator shows that in the third guarter of 2023 rooftop solar was up by almost one third compared to the same period the previous year. This, combined with warmer temperatures, reduced demand across the National Electricity Market to a record winter low and drove a 71% reduction in wholesale power prices over the period, by reducing demand for fossil fuels (AEMO 2023).

Renewable energy backed by storage is also the cheapest form of new electricity. As coal-fired generators reach the end of their natural life and need to be decommissioned, Australia needs to add more capacity to our grid. The CSIRO GenCost Consultation Draft (2024-25) confirms that renewables with firming (storage and transmission) are the cheapest form of new electricity. This calculation is based on the levelised cost of electricity (LCOE), which measures the costs a generator must recover over its lifetime to meet all its costs and deliver a return on investment. In the CSIRO report, the LCOE has a high and low assumption to create a range for each technology. The LCOE range for renewables with integration costs is the lowest of all new-build technologies in both 2024 and 2030 (see Figure 7) (Graham, Hayward and Foster 2024).

The CSIRO GenCost Consultation Draft (2024-25) confirms that renewables with firming (storage and transmission) are the cheapest form of new electricity.



#### RENEWABLES ARE THE LOWEST-COST NEW-BUILD TECHNOLOGY

**Figure 7:** Levelised Cost of Electricity by technology for 2024 and 2030 showing that the cost range for renewables (wind and solar) with firming is lowest of all new build technologies in 2024 and 2030 (and declines between 2024 and 2030). **Source:** Graham et al. (2024).

The anticipated increase in renewable generation under the most likely scenario in the Australian Energy Market Operator's Integrated System Plan (Step Change Scenario) is expected to drive a decline in residential electricity prices over the next decade. The outlook is that residential electricity bills will fall by 13% over the next ten years, provided that policies to coordinate the renewables rollout are well coordinated and investment is timely and efficient (AEMC 2024).

Residential electricity bills will fall by 13% over the next ten years, provided that policies to coordinate the renewables rollout are well coordinated and investment is timely and efficient.

#### **RENEWABLES ARE CUTTING CLIMATE POLLUTION**

Renewable energy is safe, low-cost and clean. It has already reduced climate pollution from our electricity system by almost a quarter (23%) since 2005. Unfortunately, this has not resulted in a substantial reduction in emissions from fossil fuels, because emissions from other fossil-fuel based sectors such as transport, stationary energy and fugitives have been rising over the same period (see Figure 8 below). However, the reduction in emissions in the electricity sector is good progress – as decarbonising the electricity sector (whilst increasing electricity generation) is crucial for getting rid of fossil fuels from other sectors such as transport and stationary energy through electrification.



Figure 8: Since around 2009 emissions have been trending downwards in the electricity sector, but emissions from other sectors such as stationary energy, transport and fugitive emissions have been going up. Source: DCCEEW (2024b).

### 5.

# Conclusion

Australians back renewable energy, but some media narratives and vested interests have muddied the waters. While some projects have faced genuine opposition due to poor execution and inadequate community engagement, these are the exception, not the rule. The renewable energy industry must do better – real benefitsharing and community growth should be the standard, not the minimum. Knowledge is power, and that's where the opportunity lies. Most Australians don't realize that 40% of our electricity already comes from renewables or that clean energy projects like the Snowy Hydro have been delivering for decades. Misconceptions leave room for misinformation, delaying progress and sowing unnecessary doubt.

The reality is clear: coal is on its way out, and Australia's energy transition is well underway – but it must accelerate. With world-class renewable resources, proven technology, and strong public support, we can deliver a green grid faster. The path forward is simple: ramp up awareness, build trust through genuine community engagement, and stay the course.

Australia is smashing renewable energy records, leading the world in rooftop solar and battery storage. Yet, many Aussies underestimate our progress and don't see the full picture.

The stakes couldn't be higher. We owe it to future generations to act decisively and make the switch to clean energy, securing a safer, greener, and more prosperous future for all.

Let's get it done.

Australia is smashing renewable energy records, leading the world in rooftop solar and battery storage. Yet, many Aussies underestimate our progress and don't see the full picture.

## References

Akaysha Energy (2024) Waratah Super Battery. Accessed: https://akayshaenergy.com/projects/waratah-super-battery

AEMO (Australian Energy Market Operator) (2023) Quarterly Energy Dynamics Q3 2023. Accessed: <u>https://aemo.com.</u> au/-/media/files/major-publications/qed/2023/qed-q3-2023-report.pdf?la=en

AEMO (2024a) 2024 Integrated System Plan for the National Electricity Market: A Roadmap for the Energy Transition. Accessed: <u>https://aemo.com.au/-/media/files/major-</u> <u>publications/isp/2024/2024-integrated-system-plan-isp.</u> <u>pdf?la=en</u>

AEMO (2024b) Connections Scorecard: September 2024. Accessed: https://aemo.com.au/-/media/files/electricity/ nem/network\_connections/connections-scorecard/2025/ september-2024.pdf?la=en

AEMC (Australian Energy Market Commission) (2024) Residential electricity price trends 2024 (November 2024). Accessed: <u>https://www.aemc.gov.au/sites/default/</u> <u>files/2024-11/Price%20Trends%202024%20Final%20</u> <u>Report.pdf</u>

ARENA (Australian Renewable Energy Agency) (2024) Concentrated Solar Thermal. Accessed: <u>https://arena.gov.</u> <u>au/renewable-energy/concentrated-solar-thermal/</u>

Blakers, A., Stocks, M., Lu, B., Anderson, K., and Nadolny, A. (2017) An Atlas of Pumped Hydro Energy Storage. Accessed: https://arena.gov.au/assets/2018/10/ANU-STORES-An-Atlas-of-Pumped-Hydro-Energy-Storage-The-Complete-Atlas.pdf

Blakers, A. (2024) Land requirement for a 100% renewable (zero carbon) economy is 1,200 km<sup>2</sup>. Accessed: <u>https://cdn.theconversation.com/static\_files/files/3234/Detailed\_landuse\_calculation.pdf?1714372255</u>

Briggs, C., M. Hemer, P. Howard, R. Langdon, P. Marsh, S. Teske and D. Carrascosa (2021) Executive Summary - Offshore Wind Energy in Australia: Blue Economy Cooperative Research Centre, Launceston, TAS. 92p. Accessed: <u>https://blueeconomycrc.com.au/wp-content/ uploads/2022/07/BECRC\_OWE-in-Aus-Project-Exec-Summary\_P.3.20.007\_e190721.pdf</u>

Burke, P. J., Beck, F. J., Aisbett, E., Baldwin, K. G.H., Stocks, M., Pye, J., Venkataraman, M., Hunt, J and Bai, X. (2022) Contributing to regional decarbonization: Australia's potential to supply zero-carbon commodities to the Asia-Pacific, Energy, Volume 248. Doi: <u>https://doi.org/10.1016/j.</u> energy.2022.123563.

Clean Energy Council (2024) Rooftop solar shines bright as Australia surpasses four million installations. Accessed: https://cleanenergycouncil.org.au/news-resources/ rooftop-solar-shines-bright-as-australia-surpasses-fourmillion-installations

Clean Energy Regulator (2024) 2024 shapes as a recordbreaking year for renewable energy deployment. Accessed: https://cer.gov.au/news-and-media/media/2024/ november/2024-shapes-record-breaking-year-renewableenergy-deployment#:~:text=This%20year%20we%20 expect%20about,demand%20additional%20to%20the%20target. Climate Council (2024a) Seize the Sun. Accessed: https:// www.climatecouncil.org.au/wp-content/uploads/2024/11/ CC-Report-Seize-the-Sun.pdf

Climate Council (2024b) Seize the Decade: How we empower Australian communities and cut climate pollution 75% by 2030. Accessed: <u>https://www.climatecouncil.org.au/</u> <u>wp-content/uploads/2024/03/CC\_MVSA0394-CC-Report-</u> <u>Next-Wave\_V8-FA-Screen-Single.pdf</u>

DCCEEW (Department of Climate Change, Energy Efficiency and Water) (2024a) Offshore Wind in Australia. Accessed: <u>https://www.dcceew.gov.au/energy/renewable/offshore-wind</u>

DCCEW (2024b) Australia's emissions projections 2024 - chart data. Accessed: <u>https://www.dcceew.gov.au/</u> climate-change/publications/australias-emissionsprojections-2024

Essential Research (2024a) Proportion of Australia's electricity generated by renewable energy. September 2024. Accessed: <u>https://essentialreport.com.au/questions/</u> proportion-of-australias-electricity-generated-byrenewable-energy

Essential Research (2024b) Australia compared to other countries regarding the transition. April 2024. Accessed: https://essentialreport.com.au/questions/australiacompared-to-other-countries-regarding-the-transition

Essential Research (2024c) Job creation of energy sources. July 2024. Accessed: <u>https://essentialreport.com.au/</u> <u>questions/job-creation-of-energy-sources</u>

Essential Research (2024d) Cost of energy sources. July 2024. Accessed: <u>https://essentialreport.com.au/questions/</u> <u>cost-of-energy-sources-3</u>

Equis (2024) Melbourne Renewable Energy Hub. Accessed: https://equis.engagementhub.com.au/ mreh#:~:text=With%20approval%20for%20a%20 2.4.commence%20development%20in%20late%202023.

GE Renewable Energy (2020) Pumped Hydro in Australia. Accessed: <u>https://www.gevernova.com/hydropower/</u> <u>sites/default/files/related\_documents/GEA34801%20PHS\_</u> <u>Development\_Australia\_WP\_R2.pdf</u>

Graham, P., Hayward, J. and Foster J. (2024) GenCost 2024-25: Draft Consultation, CSIRO, Australia. Accessed: <u>file:///</u><u>Users/annikadean/Downloads/GenCost24-25-Executive.pdf</u>

Grattan, M. (2024) Record renewables go into the grid in 2024, generating 45% of electricity in 2025. The Conversation. Accessed: <u>https://theconversation.com/</u> <u>record-renewables-go-into-the-grid-in-2024-generating-45-of-electricity-in-2025-244746</u>

IEA (International Energy Agency) (2024) World Energy Outlook. Accessed: <u>https://iea.blob.core.windows.</u> net/assets/a5ba91c9-a41c-420c-b42e-1d3e9b96a215/ WorldEnergyOutlook2024.pdf

IEA PSSP (International Energy Agency Photovoltaic Power Systems Programme) (2023) Snapshot of Global PV Markets. Accessed: <u>https://iea-pvps.org/wp-content/</u> <u>uploads/2023/04/IEA\_PVPS\_Snapshot\_2023.pdf</u> IHA (International Hydropower Association) (2024) 2024 World Hydropower Outlook: Opportunities to Advance Net Zero. Accessed: <u>https://acrobat.adobe.</u> <u>com/id/urn:aaid:sc:us:6ba5f8fc-5ad3-4d52-a83c-</u> 0931ce5fa119?viewer%21megaVerb=group-discover

IRENA (International Renewable Energy Agency) (2024) Country Rankings Database (2022 data). Accessed: <u>https:// www.irena.org/Data/View-data-by-topic/Capacity-and-Generation/Country-Rankings</u>

Jobs and Skills Australia (2023a) The Clean Energy Generation: Workforce needs for a net zero economy. Accessed: <u>https://www.jobsandskills.gov.au/sites/default/</u> files/2023-10/The%20Clean%20Energy%20Generation\_0.pdf

Jobs and Skills Australia (2023b) The Clean Energy Generation: Supplementary Modelling Report. Accessed: https://www.jobsandskills.gov.au/download/19313/cleanenergy-generation/2384/supplementary-report/pdf

Open Electricity (2024a) Facilities - All Regions. Accessed: <u>https://explore.openelectricity.org.au/facilities/</u> <u>au/?tech=wind&status=operating</u>

Open Electricity (2024b) Tracker - All - Year (2023). Accessed: <u>https://explore.openelectricity.org.au/</u> <u>energy/nem/?range=all&interval=1y&view=discrete-</u> <u>time&group=Detailed</u>

Poruschi, L., Scovell, M. McCrea, R., Walton, A., Gardner, J. (2024) Australian attitudes toward the renewable energy transition – Part 1: General attitudes. Brisbane, Australia: CSIRO. Accessed: <u>https://publications.csiro.au/</u> publications/publication/PIcsiro:EP2024-1146

Porter Novelli (2024) Winds of Change: Regional Australians' Real Views on Renewables. Accessed: <u>https://</u> porternovelli.com.au/wp-content/uploads/2024/10/Porter-Novelli-Australia\_Winds-of-Change-Research-Report.pdf

PV Magazine (2024) Australia has 7.8 GW of utility-scale batteries under construction. Accessed: <u>https://www.pv-magazine.com/2024/10/24/australia-has-7-8-gw-of-utility-scale-batteries-under-construction/#:~:text=That%20 equals%20the%20full%2Dyear.to%2018.5%20GW%20in%20 2035.</u>

Reputex (2021) The Economic Impact of the ALP's Powering Australia Plan: Summary of Modelling Results. Accessed: https://www.reputex.com/wp-content/uploads/2021/12/ REPUTEX\_The-economic-impact-of-the-ALPs-Powering-Australia-Plan\_Summary-Report-1221-2.pdf

Ritchie, H. (2024) Solar panel prices have fallen by around 20% every time global capacity doubled. Our World in Data. Accessed: <u>https://ourworldindata.org/data-insights/</u>solar-panel-prices-have-fallen-by-around-20-every-time-global-capacity-doubled

Southerly Ten (2024) Star of the South: Project Overview. Accessed: <u>https://static1.squarespace.com/</u> <u>static/5eb3699d1492806f7759caf4/t/673bd3db14b04e</u> <u>3f12226975/1731974153952/Factsheet+overview</u>

SunWiz (2024) Battery Market Report 2024. Accessed: https://www.sunwiz.com.au/battery-market-reportaustralia-2024/

TAI (The Australian Institute) (2024) Climate of the Nation 2024: Tracking Australia's Attitudes Towards Climate Change and Energy. Accessed: <u>https://australiainstitute.</u> <u>org.au/wp-content/uploads/2024/11/Climate-of-the-</u> <u>Nation-2024-WEB.pdf</u> The Crown Estate (2023) Offshore Wind Report 2023. Accessed: <u>https://www.datocms-assets.</u> <u>com/136653/1720789954-11964\_offshorewindreport\_2023\_</u> <u>final300424.pdf</u>

United Nations (2024) What is Renewable Energy? Accessed: https://www.un.org/en/climatechange/what-is-renewableenergy#:~:text=Renewable%20energy%20is%20energy%20 derived,plentiful%20and%20all%20around%20us.

Vorrath, S. (2023) Rooftop solar saves money, and batteries can wipe out bills: Labor pushes household savings. Accessed: <u>https://reneweconomy.com.au/rooftop-solar-</u> <u>saves-money-and-batteries-can-wipe-out-bills-labor-</u> <u>pushes-household-savings/#google\_vignette</u>

# Image credits

Front Cover: Catherine Falls Commercial - Getty Images.

Image 2: Supplied by Solar My Schools program.

Image 3: Supplied by Tweed Shire Council.

Image 4: Credit: Genex.

Image 5: Supplied by The New Joneses.

Image 6: Supplied by Genex.

Image 7: Supplied by Hydro Tasmania.

Image 8: Supplied by The New Joneses.

Image 9: Credit: Rod Vargas.

Image 10: Supplied by Akaysha Energy.

Image 11: Getty images - Andrew Merry.

Image 12: iStock user Halfpoint.

Image 13: Supplied by Re-Alliance.

Image 14: iStock user ArtistGNDphotography.

# Appendix

To underpin this research, the Climate Council commissioned polling from Essential Research. We also used the results of polling previously conducted by Essential Research. The questions that we commissioned were the following:

#### 1. PERCENTAGE OF RENEWABLE ENERGY BY 2030

**Question:** Based on the Federal Government's Powering Australia Plan what percentage of our electricity will be coming from renewable energy sources by 2030?

| Less than 50%: | 17% |
|----------------|-----|
| 50-59%:        | 13% |
| 60-69%:        | 10% |
| 70-79%:        | 8%  |
| 80-89%:        | 6%  |
| 90% or more:   | 4%  |
| Unsure:        | 41% |

#### 2. CLOSURE OF COAL FIRED POWER STATIONS IN AUSTRALIA

| <b>Question:</b> To the best of your kr<br>when does the Australian Energ<br>Operator expect all of Australia's<br>power stations be closed by? | nowledge,<br>y Market<br>s coal fired |
|---|---------------------------------------|
| 2035:   | 21%                                   |
| 2040:   | 16%                                   |
| 2045:   | 8%                                    |
| 2050:   | 17%                                   |
| Unsure:   | 38%                                   |

#### 3. KNOWLEDGE OF RENEWABLE ENERGY SOURCES

**Question:** The United Nations defines renewable energy as "energy that comes from natural sources that are replenished faster than they are consumed". Which of the following would you consider to be types of renewable energy?

| Rooftop solar:              | 65% |
|-----------------------------|-----|
| Large scale solar:          | 56% |
| Onshore / offshore wind:    | 56% |
| Hydropower:                 | 55% |
| Concentrated solar thermal: | 38% |
| Green Hydrogen:             | 34% |
| Bioenergy:                  | 27% |
| Nuclear:                    | 24% |
| Gas:                        | 17% |
| Coal:                       | 12% |
| None of these:              | 7%  |

#### 4. LAND REQUIRED TO GENERATE 20 TIMES OUR ANNUAL ELECTRICITY CONSUMPTION WITH RENEWABLES?

**Question:** What percentage of Australia's total land do you think we would need to generate over 20 times our current annual electricity generation from solar and onshore wind?

| Less than 2%  | 8%  |
|---------------|-----|
| 2-5%          | 9%  |
| 6-10%         | 18% |
| 11-20%        | 11% |
| More than 20% | 21% |
| Unsure        | 32% |

#### 5. AWARENESS OF RENEWABLE ENERGY STORAGE IN AUSTRALIA?

**Question:** Renewable energy can be stored in lots of ways. To the best of your knowledge, which of the following forms of renewable storage does Australia already use?

| Household battery storage:   | 58% |
|------------------------------|-----|
| Large-scale battery storage: | 48% |
| Solar thermal:               | 38% |
| Pumped hydro:                | 35% |
| None of these:               | 15% |

#### 6. FIRST SOLAR AND WIND FARMS IN AUSTRALIA

**Question:** To the best of your knowledge, when were the following built for the first time in Australia?

| Solar farm  |                          |
|---|--------------------------|
| 1980s   | 6%                       |
| 1990s   | 14%                      |
| 2000s   | 26%                      |
| 2010s   | 15%                      |
| Unsure  | 38%                      |
|   |                          |
| Wind farm   |                          |
| Wind farm<br>1980s  | 14%                      |
| Wind farm<br>1980s<br>1990s                                       | 14%<br>16%               |
| Wind farm         1980s         1990s         2000s               | 14%<br>16%<br>20%        |
| Wind farm         1980s         1990s         2000s         2010s | 14%<br>16%<br>20%<br>13% |



To find the full results of the Essential Report that Climate Council commissioned, please visit:

Full research results

### The Climate Council is a fearless champion of the climate solutions that Australia needs. People power got us started and we are proudly community-funded and independent.

The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders, past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to land, sea and sky. We acknowledge the ongoing leadership of First Nations people here and worldwide in protecting Country, and securing a safe and liveable climate for us all.

#### **CONNECT WITH US!**



The Climate Council is a not-for-profit organisation. We rely upon donations from the public. We really appreciate your contributions.



climatecouncil.org.au/donate



Subscribe to the Climate Council today for your exclusive inside take on the latest climate science, impacts and solutions.

Visit <u>climatecouncil.org.au/join/</u>

