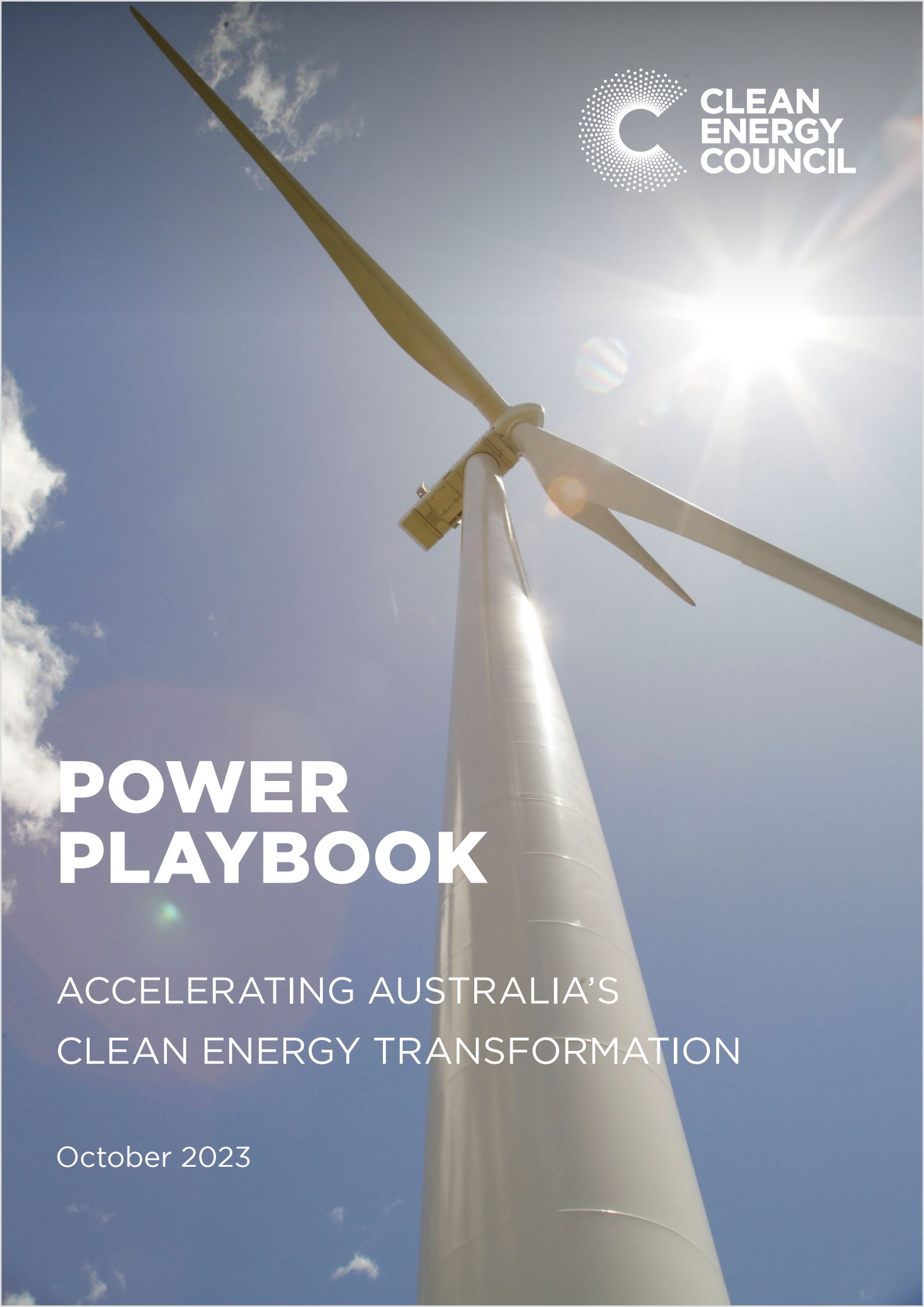


CLEAN ENERGY COUNCIL

POWER PLAYBOOK

ACCELERATING AUSTRALIA'S CLEAN ENERGY TRANSFORMATION

October 2023

The Clean Energy Council has prepared this unsolicited submission for the Australian Government to provide its analysis of how Australia can accelerate its clean energy transition and realise some of the economic opportunities unlocked by low-cost, abundant renewable energy, within the context of the global race to net zero emissions.

CLEAN ENERGY COUNCIL

The Clean Energy Council is the peak body for Australia's renewable energy sector. We represent more than 1,000 companies working across the full value chain of solar, wind, hydro, energy storage and renewable hydrogen projects and installations across the country.

CONTENTS

SECTION 1: OVERVIEW

The Clean Energy Council (CEC) welcomes the recent commitments by the Australian Government to review the implications for Australia of intensifying global competition for clean energy industries. We also note the recent announcement that the Government will develop a sectoral decarbonisation plan for the electricity and energy sectors as part of a robust Net Zero Plan for Australia.

We write to share with you our analysis of the challenges and priorities for clean energy investment, and recommendations for how we can accelerate Australia's clean energy transformation and take advantage of the immense opportunities before us.

The announced policy reviews and planning exercises provide an important and timely opportunity for Australia to take stock of its progress in the clean energy transition, and to establish the policy frameworks that can position Australia to prosper in a net zero global economy. We should grasp the opportunity with both hands.

The global imperative is clear – to urgently slash emissions by at least half by 2030 and reach net zero emissions by no later than 2050 in order to contain the worst impacts of climate change. Underperformance in emissions reductions in the coming years brings forward the net zero deadline for stabilising warming at 1.5°C.

In the face of such collective clarity of purpose and the risks of failure to our quality of life, terms of trade, economic wellbeing, and environmental and cultural heritage, there is only one sensible course of action: bold and rapid steps to decarbonise our economy and pursue new markets to underpin our net zero economic growth.

1.1 A TRANSFORMATIVE OPPORTUNITY FOR AUSTRALIA'S ECONOMY

The opportunities associated with Australia's clean energy transformation are both exciting and daunting. **Net Zero Australia's extensive study** completed earlier this year indicated that completing the domestic decarbonisation task and pursuing ambitious goals for clean energy exports (replacing LNG and coal exports) would require $7–9 trillion of capital investment, a skilled workforce in the order of 700,000–800,000 people and an electricity system in the order of 40 times the size of today's.

Other experts offer similar forecasts: renowned economist, Ross Garnaut, estimates the need for more than $6 trillion of capital expenditure and an electricity system in the order of 50 times the size of the current National Electricity Market (NEM), in order for Australia to take advantage of its 'full superpower opportunity', including renewable hydrogen, onshore minerals processing and green metals production.

These massive opportunities for economic growth and diversification into value-added green manufacturing are welcome for an economy like Australia's, which has suffered a steady decline in manufacturing and processing capabilities since its peak in the 1960s[1].

[1] Australian Manufacturing Industry – PC Submission

1.2 WE NEED A PLAN

However, Australia's potential alone will not assure our success. We will need to make our own luck by carving out the role we wish to occupy in emerging markets. Actions will need to be deliberate and decisive. And they will need to be grounded in robust strategic analysis and planning that identify the market opportunities we wish to capture in the global clean energy transition. This analysis must be followed by a clear strategy, targeted policy support, substantial public and private investment, and deep collaboration across government and industry.

While a wide range of plans and strategies are being developed by Government across a range of areas, from hydrogen and critical minerals to sovereign manufacturing capabilities (via the National Reconstruction Fund), we are currently lacking a framework to bring the domestic transition and the international opportunities together, understand the resource and infrastructure requirements in capturing these opportunities, and provide a cohesive roadmap for co-ordinated public and private investment. This is the **Renewable Energy Superpower Masterplan** that the Clean Energy Council has been calling for over the past year. See an outline of the proposed plan in **Appendix 1.**

With refinement of its terms of reference, the Net Zero Authority could ultimately be best placed of all the existing government agencies to play an overarching co-ordination role in developing and overseeing the delivery of this plan.

It is vital that Australians are brought along on the journey to a net zero economy, and an important element of the Authority's role could also be to support the national communications effort in promoting the vision and rationale for this society-wide renewal, explaining the opportunities and challenges it offers, and reporting on progress as we advance.

Recommendation 1.1: The Australian Government should develop a 'Renewable Energy Superpower Masterplan' for Australia. The purpose of the masterplan is to articulate a national vision for the role Australia intends to play as a producer and exporter of clean energy and green value-added commodities, identify priority/target markets, and guide the allocation of public and private investment and resources.

Recommendation 1.2: Empower the Net Zero Authority to play a key role in communicating the vision, opportunities and challenges, as part of bringing Australians on this nation-building journey. This could be combined with yearly public reporting on how we are tracking with implementing the Renewable Energy Superpower Masterplan.

1.3 THE GLOBAL RACE FOR NET ZERO IS ON

We must move quickly. Around the world, the race to net zero is intensifying, as countries and regions move to stake their ground in a new world order, in the wake of the Russian invasion of Ukraine and then perhaps, more consequentially, the passing of the Inflation Reduction Act (IRA) in August 2022. Australia is at great risk of being left behind if it does not respond decisively, and soon.

Capital flows are already on the march. In the last 12 months since the US$369 billion clean energy and climate package was signed into law by President Biden, the world has witnessed a virtual tidal wave of investment announcements in the US market, including:

- Over US$270 billion in capital investments
- 185 GW of new clean energy project capacity
- 83 new or expanded manufacturing facilities, including 52 solar, 11 onshore wind power, 6 offshore wind power and 14 utility-scale battery storage manufacturing facilities.
- Almost 30,000 new manufacturing jobs[2].

The wave of infrastructure investments thus far prompted Morgan Stanley to make a sizeable upwards revision to its gross domestic product forecasts in July 2023[3].

And with a large portion of the IRA incentives allocated to uncapped tax credits, Goldman Sachs now estimates that the clean energy spending by Biden's Government could triple to US$1.2 trillion. However, the investment bank also forecasts that the raft of incentives will in turn unleash US$3 trillion in clean energy/low-emissions investments across the economy, more than delivering a return for the expected outlay.

Canada, whose economy shares a number of similar characteristics to that of Australia's, swiftly announced its own 'Made in Canada' plan in its March 2023 federal budget, largely aimed at matching the IRA in key areas. The plan committed a total of C$80 billion over a decade to clean energy tax credits and sustainable infrastructure investments, including almost C$18 billion[4] (AUD ~$20.6 billion) for hydrogen investment between 2023 and 2035.

The European Union, which initially protested at the trade-distortive subsidies of the IRA ultimately unveiled its own response in January 2023, committing to develop its own Net Zero Industry Act, Critical Raw Minerals Act, European Sovereign Fund and European Hydrogen Bank, which are collectively expected to provide equivalent levels of support to European green industries (though perhaps less efficiently), as noted by the Brussels-based Bruegel think tank:

The expected IRA green subsidies are of similar size to those available in the European Union, except in renewable energy production, where EU subsidies remain far larger. However, there are important qualitative differences. Some IRA subsidies discriminate against foreign producers while EU subsidies do not. IRA clean-tech subsidies are simpler and less fragmented, and they focus mainly on mass deployment of green technologies rather than innovation.[5]

Many other economies have also moved quickly to signal their green energy ambitions, including Saudi Arabia, which has announced US$266 billion to support renewable energy investments and clean hydrogen exports, and India, which has bolstered its investment in solar PV manufacturing and battery manufacturing supply chains.

[2] Clean Energy Investing in America | ACP (cleanpower.org)
[3] Bidenomics spurred stronger GDP growth: Morgan Stanley (cnbc.com)
[4] Chapter 3: A Made-In-Canada Plan: Affordable Energy, Good Jobs, and a Growing Clean Economy | Budget 2023
[5] Bruegel, How Europe should answer the US Inflation Reduction Act, February 2023

1.4 THE AUSTRALIAN GOVERNMENT HAS MADE SOLID PROGRESS OVER THE PAST YEAR

So far, Australia's response to the IRA has been hesitant and partial. The May 2023 Federal Budget saw a commitment to $1.7 billion for low-cost loans to homes and businesses for electrification and funding for social housing, small business and local governments to support electrification and energy efficiency, as well as $2 billion for the Hydrogen Headstart program to accelerate the scale-up of the green hydrogen sector in Australia. This is expected to support at least two large-scale projects to get off the ground through a competitive process that will provide a hydrogen production credit to successful projects that bridges the gap between production costs and estimated sales price. This program has been clearly recognised by the Australian Government as a 'downpayment' on the development of a domestic green hydrogen industry, which will be complemented by a larger response at the conclusion of the Government's global competitiveness review.

The Government has also been engaging closely with the US Government to explore opportunities to maximise the benefits of our Free Trade Agreement for supplying critical minerals to the burgeoning electric vehicle (EV) supply chain in the US, as a result of the IRA. It is imperative that Australia asserts itself in these discussions to carve out a more expansive role in the downstream processing of energy transition minerals, to take advantage of an opportunity for economic diversification, and provide regional jobs and support – not simply expand mine development.

These efforts are in addition to the implementation of the Albanese Government's existing policy agenda to support the delivery of Australia's national emissions reduction target of 43 per cent by 2030, achieve an 82 per cent share of renewables in the grid, and support a fair transition for coal communities. This agenda has included initiatives such as:

- the roll-out of transmission across Australia via the Government's landmark $20 billion Rewiring the Nation program
- a commitment to support investment in large-scale storage/dispatchable zero-emissions capacity via the forthcoming Capacity Investment Scheme
- a robust policy framework to drive down industrial emissions through the newly reformed Safeguard Mechanism, the $1.9 billion Powering the Regions Fund and the $3 billion National Reconstruction Fund, and
- a new Net Zero Authority to co-ordinate a smooth and fair transition for communities and workers affected by the transition.

These policies, investments and structures complement existing avenues for the delivery of grants and concessional finance to renewable energy and energy efficiency projects through the highly effective Australian Renewable Energy Agency (ARENA) and Clean Energy Finance Corporation (CEFC).

1.5 A DRAMATIC INCREASE IN INVESTMENT IS NEEDED

While this inventory of policy achievements represents significant progress since the Albanese Government took office just over a year ago, the CEC is concerned that these measures will be insufficient for Australia stake its claim as a global clean energy leader in the context of unprecedented investments by other major economies over the past year.

The International Energy Agency Renewables 2022 report[6] revised up its forecasts for global renewable energy capacity build by 30 per cent on the previous year, largely because:

> *China, Europe, the United States and India [were now] implementing existing policies, regulatory and market reforms and new policies more quickly than expected to combat the energy crisis[7].*

And this was before the effects of the current clean energy 'arms race' were fully apparent. As a mid-sized economy at significant distance from major markets, and a technology taker rather than maker, Australia will need to work harder to attract investment and supply chain interest.

We note that the Centre for Future Work recently released an analysis of the quantum of expenditure that Australia would be allocating to clean energy investment if it were to take a proportionate approach to that of the United States[8] (by population). It found, as shown in the table below, that the amount would be in the order of AUD$83–138 billion, depending on the ultimate cost of the IRA.

Proportionate scale of IRA and related funding

	Low estimate	*High estimate*
Ten-year cost of IRA and related programs	US $750bn	US$1250bn
Exchange rate (OECD PPP)	1.419	
Australian population share	7.8%	
Equivalent scale	AUD $82.6bn	AUD $137.7bn
Annual cost	AUD $8.3bn	AUD $13.8bn

Table 1. Centre for Future Work's analysis of proportionate funding for an Australian clean energy investment package

While the Clean Energy Council expects that Australia will need to take a more targeted approach to its clean energy investment strategy than the United States, given the size and structure of its economy, we nevertheless consider that a much larger investment will be required by the Australian Government than has been made to date in order to secure our competitiveness for capital, equipment and skilled workers.

The Government should commit – as soon as possible – to a nation-building Clean Energy Transformation Investment Package capable of boosting and retaining Australia's international competitiveness as a producer of renewable energy and green value-added commodities, which can position Australia to prosper in a carbon-constrained world. We expect that the scale of this fund would be in the order of $10 billion per year for at least ten years. These funding levels may need to be extended in response to evolving conditions.

6 Renewables 2022 (windows.net)
7 Renewable electricity – Renewables 2022 – Analysis - IEA
8 Joyce, C., Stanford, J., Manufacturing the Energy Revolution, Centre for Future Work at The Australia Institute, August 2023

Recommendation 1.3: The Australian Government should commit to – as soon as possible, and no later than the 2024–25 Federal Budget – a nation-building Clean Energy Transformation Investment Package capable of boosting and retaining Australia's international competitiveness as a producer of renewable energy and green value-added commodities, in the order of $10 billion per annum for at least ten years), or a minimum of $100 billion.

1.6 WE NEED TO SOLVE FOR SUCCESS WITH AMBITIOUS, LONG-TERM POLICY SETTINGS

Ambitious, long-term policy settings will be key to our success. If Australia wants to ensure that it can meet its goals, it needs to signal strongly to domestic and international markets as soon as possible, what it aims to achieve by when, and design durable policy frameworks to support its ambitions.

Over the past decade, we have seen a proliferation of ad hoc and time-limited funding rounds and grants to stimulate investment, which have sought to skirt around a distaste or reluctance for broad, market-based policy settings. While these initiatives have been helpful to some extent, this incremental approach is inadequate for stimulating sustained investment and driving deep structural changes across the economy. With clear emissions reductions goals now firmly in place, it is time to build the comprehensive policy frameworks that solve for success.

Finally, we urge speed in Australia's response. Capital is on the march and delay will be damaging to Australia's prospects of success. It will extend the timeframes for which Australia will be a high-emissions economy, and place us at the back of the queue for the technology and skills we need to compete in emerging green commodity markets.

1.7 LOW-COST RENEWABLES WILL UNDERPIN OUR SUCCESS

Low-cost, renewable energy is the foundation for our aspirations as a clean energy superpower, and the decarbonisation of Australia's electricity system is a pre-condition for the wider economic transformation. The sectoral decarbonisation plan for the electricity and energy sectors should target the full decarbonisation of the electricity sector by 2035.

We are not a low-cost power producer today, relative to many other aspiring clean energy leaders (e.g. regions of Latin America, the Gulf states). While our natural advantages indicate that we should and can be a world-beater in low-cost renewables, the below Deloitte analysis serves as a useful yardstick in terms of the distance still to travel down the cost curve. Hydrogen is a highly-electricity intensive product, and positioning ourselves as a globally competitive producer of green hydrogen – as Australian governments have committed to – will necessitate a significant increase in the scale and speed of renewable energy deployment.

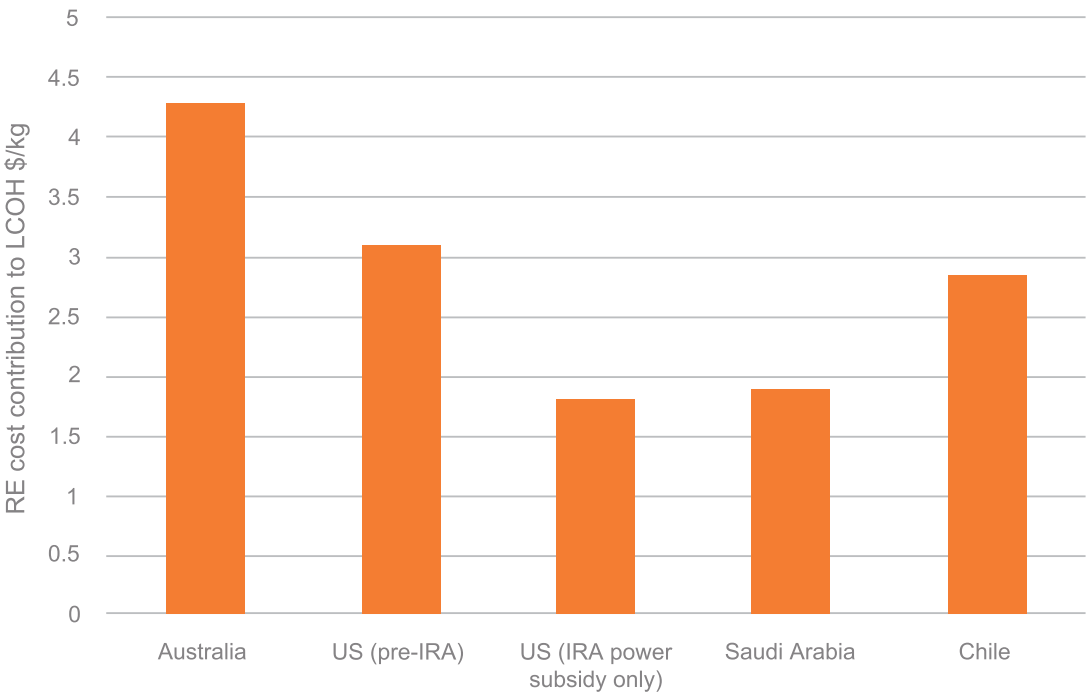


Figure 1: Competitor markets are reducing renewable prices rapidly, which in turn offers potential to produce cheaper renewable hydrogen

Notes: Deloitte market analysis from interviews. Charted data shows the contribution of renewable prices observed in different markets on levelised cost of hydrogen. Only the energy component of LCOH is shown. Other elements contribute to LCOH including capital expenditure, O&M, labour and water. The chart assumes that renewable power costs $65/MWh in Australia, $50/MWh in the US pre IRA, $30/MWh in the US post IRA, $32/MWh in Saudi Arabia, and $48/MWh in Chile.

An emerging hydrogen sector is not the only energy-intensive sector which would benefit from such a reduction – our small, but strategically important, industries of alumina refining, aluminium smelting, iron and steel manufacturing, and the processing of critical minerals, would all benefit from globally competitive electricity prices. Assisting the electricity sector to deliver this competitive advantage must be at the centre of Australia's economic development strategy. A range of actions are discussed in Sections 2 and 3 of this submission.

Recommendation 1.4: Prioritise the transformation of Australia's electricity system as the foundation for 'green growth', targeting the full decarbonisation of the electricity sector by 2035 in the Government's new sectoral decarbonisation plan.

1.8 GETTING TO 82 PER CENT RENEWABLES AND (WELL) BEYOND

Unfortunately, today's renewable energy deployment rates are currently well below the required level to complete the decarbonisation of the electricity grid within target timeframes. While we have seen some encouraging investment indicators for utility-scale storage in recent times, new generation projects have slowed dramatically. This indicates that new policies and incentives will be required to support new clean electricity supply to enter the market.

In the remainder of this submission, the CEC zeroes-in on how the Australian Government can accelerate the clean energy transformation of our electricity system to achieve its goal of 82 per cent renewables by 2030, lower power prices for households, businesses and industry, and meet the growing needs of a net zero economy.

Section 2 focuses on boosting investment in and deployment of the three key elements of a low-cost, renewable electricity system: generation, storage and transmission.

Section 3 details the policy and implementation priorities for the key enablers of the transition:

1. Strong social licence for the clean energy transition
2. Efficient planning and environmental assessments process
3. Building a large, skilled and diverse workforce
4. Robust supply chains

Section 4 addresses priorities for leveraging our growing clean electricity advantage to electrify buildings and transport.

Section 5 considers the opportunities and priorities for building green value-added production exports, including hydrogen and minerals processing.

The key recommendations of this submission are outlined below, and discussed more fully in the relevant sections.

1.9 CONCLUSION

Australia has a transformative opportunity before it to leverage its tremendous renewable energy advantage for unprecedented economic expansion and green growth. But it cannot rely on its natural advantages alone to capture this opportunity. In the context of a global race to net zero emissions, we will need to act decisively to create our own luck. It will require levels of planning, co-ordination and investment the likes of which we have seen only in times of war or crisis.

This defining moment in time – the climate crisis – deserves no lesser focus.

If we move boldly and swiftly, we can position our economy to navigate the disruptive global energy transition and emerge as winners from the transition to net zero, while giving effective global climate action a greater chance of success.

And that is surely worth the investment.

Yours sincerely,

Kane Thornton
Chief Executive Officer

SUMMARY OF RECOMMENDATIONS

#	Recommendation	Page
1. Overview		
1.1	The Australian Government should develop a 'Renewable Energy Superpower Masterplan' for Australia. The purpose of the masterplan is to articulate a national vision for the role Australia intends to play as a producer and exporter of clean energy and green value-added commodities, and to guide the allocation of public and private investment and resources.	5
1.2	Empower the Net Zero Authority to play a key role in communicating the vision, opportunities and challenges, as part of bringing Australians on this nation-building journey. This could be combined with yearly public reporting on how we are tracking with implementing the Renewable Energy Superpower Masterplan.	
1.3	The Australian Government should commit to – as soon as possible, and no later than the 2024–25 Federal Budget – a nation-building Clean Energy Transformation Investment Package capable of boosting and retaining Australia's international competitiveness as a producer of renewable energy and green value-added commodities, in the order of $10 billion per annum for at least ten years), or a minimum of $100 billion.	9
1.4	Prioritise the transformation of Australia's electricity system, targeting the full decarbonisation of the electricity sector by 2035 in the Government's new sectoral decarbonisation plan.	10
Section 2: Accelerating the deployment of generation, storage and transmission		
2.1: Accelerating the deployment of renewable electricity generation		
Large-scale		
2.11	Provide a long-term national policy mechanism to drive increased and sustained investment in large-scale renewable energy projects and support achievement of an 82 per cent renewable energy share by 2030. The CEC's preferred option is to increase the Large-scale Renewable Energy Target (LRET) and extend it beyond 2030 to at least 2040 as the most efficient and effective option.	23
2.2: Accelerating the deployment of energy storage (incl. distributed solar & storage)		
Utility-scale/bulk storage		
2.21	In regards to the CIS, the CEC recommends that: **The 6GW target be set as a floor, rather than a cap.** This will allow for additional storage capacity volumes to be brought forward as necessary. **Timeframes for the CIS be extended, to recognise the storage volumes that will be required out to 2040 and 2050,** and that different storage technologies have different risk profiles and lead times for delivery. **The CIS be designed to purposefully encourage a mix of technology solutions,** by either partitioning the scheme itself, or explicitly valuing the specific capabilities of different technologies. **Flexibility be purposefully designed into the CIS,** allowing the scheme to flex to account for a rapidly changing technological and commercial environment.	26

2.22	Governments should direct the AER, AEMC and AEMO to focus their work around developing techno-regulatory frameworks that explicitly recognise and value the capabilities of energy storage, and avoid simply mandating capability through regulatory standards.	26
Distributed solar & storage		
2.23	Set a national rooftop solar target for 2030 and 2040, reflecting the Step Change scenario.	28
2.24	Set a National distributed energy storage and flexible energy target for 2030 and 2040, reflecting the Step Change scenario.	
2.25	Support distributed battery installation uptake through an expansion of the Small-scale Renewable Energy Scheme (SRES), which will enable Australia to better exploit the immense value of rooftop solar, and support a more flexible and resilient system.	
2.26	Prioritise the national co-ordination and delivery of the CER Implementation Plan to reward rooftop PV and storage for participation in wholesale markets and ancillary services markets, and that networks pay for access to solar generation and storage for network services through nationally consistent charging and accessing arrangements.	
2.3: Supporting emerging forms of renewable energy generation		
Offshore wind		
2.31	Set a national offshore wind target to provide investor certainty in relation to the scale and ambition of Australia's offshore sector, supported by a policy support mechanism which can drive contracting.	31
2.32	Lead the development of a national ports strategy, which considers Australia's ports network as a whole and the demands that will be placed on it as a result of growing and emerging clean energy markets, including the offshore wind sector.	
2.33	Provide targeted support and co-ordination for transmission enhancements to service key offshore wind zones.	
2.34	Introduce incentives or financial support to ensure dedicated installation vessels are available to meet domestic needs.	
2.35	Provide government support for environmental analysis of declared offshore wind regions, specifically coordination of regional marine baseline studies to ensure optimisation of niche research resources and avoid delays to projects waiting on required environmental studies.	

2.4: Transmission deployment		
2.41	Evaluate the benefits of a co-ordinated national delivery plan for all transmission projects of national significance to deliver cost and time savings.	34
2.42	Ministers to provide the AEMC with explicit instruction to consider the benefits of enhancing network resilience to the effects of climate change, through the NEO Harmonisation rule changes.	
2.43	Ministers to provide funding for an industry collaborative approach to enable non-network solutions and to develop a circular planning model.	
2.44	Ministers to direct concessional financing towards addressing 'blackspots' on the transmission network.	
Section 3: Key enablers of our clean energy transformation		
3.1: Social licence		
3.11	Industry and governments should partner to jointly develop a best practice framework for community benefit sharing for large-scale generation, storage and transmission projects to ensure that host communities, including farmers and First Nations, enjoy the benefits of Australia's clean energy transformation.	37
3.12	State Governments, supported by the Federal Government, should develop comprehensive programs to clearly communicate the importance of Renewable Energy zones, and renewable energy projects to communities in these areas.	
3.13	Federal and State governments should jointly fund REZ Readiness Plans that assess local capabilities (e.g. Business capacity to support/supply projects, accommodation availability, skills/training needs), regional logistical constraints and community needs, to identify barriers and solutions to ensure smooth project deployment in each REZ and a reduction in disruption to local communities.	
3.14	The Federal government should create the Prime Minister's Prize for Renewable Energy Innovation. This major funding round or competition would fund innovative utility-scale projects (not pilots) that demonstrate and measure how renewable energy can be deployed in ways that are "net positive" on their local environment. Funded projects should identify the incentives and reforms required to ensure these approaches and practices can be adopted commercially in the future.	
3.2: Efficient planning & environmental assessment processes		
3.21	The Commonwealth, state and territory governments need to build additional capacity within their planning and environmental assessment units and referral agencies in order to expedite assessment processes and provide transparency and clarity to projects as quickly as possible.	38
3.22	Governments can support efficient project development by undertaking region-wide environmental and social assessments of prospective renewable energy zones/regions, which will help direct development activity to suitable areas and reduce upfront costs and overall development timeframes for proponents.	

3.3: A large, skilled and diverse workforce		
3.31	Revisit higher education funding models to better align them with industry needs. These needs would be informed by mechanisms established to better anticipate workforce needs.	40
3.32	Work with State Governments to develop credible estimates of future clean energy workforce needs, to enable planning to meet industry needs.	
3.33	Work with State Governments to provide strategic support and resources for training organisations to respond to industry needs.	
3.34	Enhance the vocational education and training sector's capacity to understand and meet the demands of industry.	
3.35	Establish a clean energy skills funding package. The package should offer targeted support for training facilities to upskill regional workers in advance of critical transmission and renewable energy infrastructure development.	
3.36	Raise the international profile of Australia as a centre for clean energy expertise, in order to retain and attract relevant professionals, and encourage aspiring young minds into relevant higher education.	
3.4: Robust supply chains		
3.41	The Federal Government should take the lead on strengthening domestic supply chains, developing a **National Clean Energy Supply Chain Strategy.** The success of any such strategy relies on credible, stable, ambitious, and long-term energy policies which provide an attractive investment environment. This strategy should include: • A whole-of-value-chain approach • Recognition of our competitive advantages • Substantial targeted government incentives for new local supply chain and manufacturing capability – facilities that utilise innovative technologies could attract higher levels of financial support. • Readily achievable targets, paired with capability and capacity building • Identification of priority green industrial clusters/zones • Consideration of critical infrastructure needs • Support for standards and domestic testing capabilities • A workforce plan • Futureproofing to automation and robotics • Support for the recycling of clean energy equipment at the end of life.	44

3.42	Establish an effective solar PV recycling stewardship scheme. The clean energy sector supports the impost of an end-of-life collection and recycling levy that would apply to manufacturers or suppliers of solar PV modules, which would set a specific price per weight or product.	44
Section 4: Electrification of buildings and transport		
4.1	Communicate end dates for the sale of combustion-based household appliances and vehicles. These timeframes should be set as soon as possible in alignment with achieving Australia's goal of net zero emissions by 2050.	46
4.2	*New gas* connections for homes and light commercial businesses (e.g. retail, offices) on the distribution network should be immediately banned by governments across Australia.	
4.3	Provide incentives for early movers, ensuring that wherever appliances are replaced, consumers are strongly incentivised to select a more efficient electric appliance or vehicle. Priority should be given to supporting low-income households to be among the early movers.	
4.4	Introduce a tax write-off for landlords who opt to replace broken gas-based appliances with efficient electric ones.	
4.5	Employ regulation to enforce change by outlawing the sale of less efficient appliances and vehicles through tightening efficiency standards, including the promised fuel-efficiency standard for vehicles.	
4.6	Work with states and territories to invest strongly in clear and sustained public information throughout the electrification transition.	
4.7	Work with states and territories to invest in workforce attraction and development for electricians, plumbers and other related occupations who will be vital to competently and safely manage the electrification transition.	
Section 5: Green value-added production and exports		
5.1: Green hydrogen		
5.11	Expedite detailed strategic land use and infrastructure planning for identified hydrogen hubs/green industrial zones. This planning should consider the integrated system needs of a hydrogen production industry, and sector coupling opportunities (e.g. green iron, fertiliser production etc).	51
5.12	The Australian Government should outline its long-term support arrangements for large-scale hydrogen projects as soon as possible. We recommend that between $15–$20 billion should be allocated to revenue support for early mover projects over 10–15 years, as part of a broader $100 billion Clean Energy Transformation Investment Fund.	
5.13	The Federal, State and Territory governments should set firm long-term targets for local, green materials content within their infrastructure projects, which could provide much-needed demand for the establishment of zero or low carbon manufacturing facilities.	

5.14	The proposed Guarantee of Origin framework should be implemented in a timely manner, alongside the implementation of recommendation 2.11 (RET increase and extension), to provide Australia with an essential mechanism to be able to demonstrate the renewable electricity and environmental credentials of the products we produce, for both domestic and international consumption.	51
5.2: Minerals processing, including green iron		

5.21	The Australian Government should:
	• Re-build and expand Australia's mineral processing capabilities through investment attraction strategies.
	• Outline the Government's vision and objectives for an expanded role in value-added processing in the battery supply chain.
	• Provide a substantial funding allocation within the Clean Energy Transformation Investment Fund to attract investment in energy transition minerals processing plants in Australia. This support could be offered in a variety or combination of ways, including production tax credits, capex subsidies, and tax write-offs. The criteria for accessing this financial support should be as simple and straight forward as possible.
	• Move to quickly declare green iron a priority development market, in light of the symbiotic relationship between green hydrogen and green iron, and the long lead times for new capital-intensive plant.
	  • Support R&D efforts to enable a green iron industry to utilise our large hematite resources.
	  • Allocate at least $10-15 billion of the Clean Energy Transformation Investment Fund to attracting early mover green iron plants in Australia over the coming decade.
	• As discussed in Section 5.1, set firm long-term targets for local, green materials content within infrastructure projects, which could provide much-needed demand for the establishment of zero or low carbon green iron manufacturing facilities.
		54

SECTION 2: ACCELERATING THE DEPLOYMENT OF GENERATION, STORAGE AND TRANSMISSION

Low-cost, renewable energy – the foundation of Australia's net zero transformation

The build out of bulk electricity and storage at scale, supported by a strengthened and expanded transmission system will be key to delivering not just our own domestic emissions reductions goals, but also for establishing Australia as an attractive destination for energy-intensive processing of green value-added commodities, such as hydrogen and its derivatives, fertilisers, green iron and alumina.

The three elements of low-cost renewables: generation, storage and transmission

AEMO has clearly detailed in previous Integrated System Plans that a combination of variable renewable energy (wind and solar) and energy storage (batteries, pumped hydro and the many other forms of long-duration energy storage [LDES] technologies) will deliver lowest cost electricity supply, as coal-fired power generators retire. This generation and storage capacity will need to be supported by a much larger electricity transmission network.

It is vital that this generation, storage and transmission capacity is deployed ahead of coal generation retirements, in order to support a smooth transition and avoid electricity market volatility and price spikes.

We note that these three elements – generation, storage and transmission – act both as complements, as well as partial substitutes, for each other, as illustrated in the figure below. For example, changing the amount of generation built may be enabled through a change in either (or both) the amount of:

- transmission – to enable better sharing of available generation through space,
- storage – to enable better sharing of available generation through time.

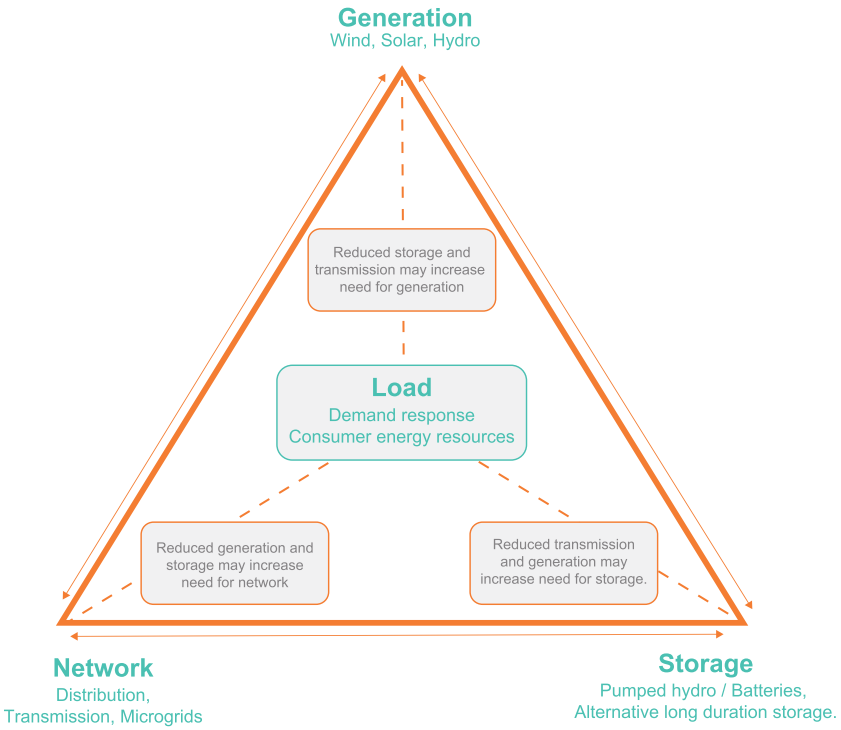


Figure3: Interdependencies between Australia's build out of generation, storage and transmission infrastructure

AEMO's Step Change scenario set out within the 2022 Integrated System Plan, indicates that the following investments in generation, storage and transmission would be required in order to achieve ~82 per cent by 2030, and then 96 per cent renewable energy by 2040.

Table 2: Capacity requirements in electricity, storage and transmission according to AEMO's 2022 Integrated System Plan Step Change scenario

Additional investment	2023–24	2030–31	2040–41
Bulk (large-scale) renewable energy generation	27 GW	55 GW	91 GW
Bulk energy storage	1.6 GW	7.5 GW	13 GW
Additional transmission build	-	4,000 km	7,300 km
Rooftop solar PV	21 GW	37 GW	55 GW
Distributed energy storage (orchestrated & unorchestrated)	1.85 GW	11 GW	33 GW

Today, however, the deployment rates for each of these elements are inadequate to achieve our renewable energy targets. In the following section, we discuss the challenges and recommended policy responses in order to accelerate the infrastructure roll-out.

2.1 ACCELERATING THE DEPLOYMENT OF RENEWABLE ELECTRICITY GENERATION

Large-scale generation

In the last six years, Australia has made significant strides, growing the renewable energy share from roughly 15 per cent in 2017 to approximately 36 per cent today, in large part supported by the Renewable Energy Target (RET) certificate scheme and the Small-scale Renewable Energy Scheme (SRES).

The Albanese Government has now set an official target of 82 per cent renewables by 2030, based on electricity market modelling forecasts carried out by both Reputex and AEMO's 2022 Integrated System Plan Step Change scenario. Based on current electricity demand forecasts for the NEM, the WA South-west Integrated System (SWIS) and the NT's Darwin-Katherine Integrated System (DKIS), this 82 per cent target represents roughly 221,000 GWh of generation per annum in 2030. Generation will ultimately need to far exceed this level to reach net zero emissions and build a green energy exports sector. Today, the total renewable energy generation in these three systems is approximately 80,000 GWh.

While increasing the existing share of renewable energy generation to 221,000 GWh by 2030 is achievable and there is strong investment appetite given the right conditions, the CEC is concerned that financial investment commitments and construction starts for new **large-scale projects** are in a state of steady decline. The 12-month rolling average for financial investment commitments is now at 40 per cent of the peak seen in the last quarter of 2018, and we have seen just ~350 MW of new large-scale generation capacity committed in the first six months of the 2023 calendar year[10]. This falls well short of the pace required to meet our 82 per cent target, let alone to support future green energy export opportunities. According to our analysis, to meet the Government's domestic target, Australia needs to be seeing annual commitments and construction starts in the order of 5–7 GW of new wind and solar farms from this year onwards.

The story in **rooftop solar** is brighter. It has been the stellar performer of the clean energy transition averaging deployment rates of 3 GW per year over the past two years, supported by consumer responses to the Small-scale Renewable Energy Scheme (SRES), falling PV module costs and rising wholesale electricity prices. However, to realise AEMO's forecast of a 20 per cent share of additional renewable energy generation between now and the end of the decade, rooftop solar's impressive performance will nevertheless need to rise to an average of ~3.6 GW per annum. See Section 2.2 for a discussion of the evolution of the SRES scheme.

[10] Renewable-Projects-Quarterly-Report-Q2-2023.pdf (cleanenergycouncil.org.au)

2.2 BARRIERS TO INVESTMENT IN LARGE-SCALE GENERATION

There are multiple factors influencing the downturn in large-scale investment. The first among them in recent years has been the long-term under-investment in network capacity to address congestion and constraints, followed by concerns and challenges related to the grid connection process and technical requirements.

Figure 3: Top business challenges for the large-scale renewable energy sector

The Clean Energy Council acknowledges the strong support from the Albanese Government to address inadequate transmission investment through the $20 billion Rewiring the Nation fund. This needs to be deployed as swiftly as possible to accelerate actionable transmission augmentation projects across Australia. The Clean Energy Council has also been working collaboratively with AEMO over the past two years on the Connection Reforms Initiative, aimed at improving the grid connections process to enhance process transparency and reduce investment risk. These issues are discussed further in **Section 2.4** of this submission on *'A robust and resilient transmission network.'*

Beyond grid connection challenges, other key challenges that are increasingly raised by members are:

- Heightened uncertainty about the role that State Governments intend to play in the ownership of renewable electricity generation, which it is feared could crowd out private capital.
- Challenges in navigating planning and environmental assessment processes, which are proving to be lengthy, complex, costly, and in some cases, lacking in transparency. These issues are discussed further in Section 3.2, *'Efficient planning and environmental assessment processes'*
- Rising project costs as a result of price inflation and volatility for equipment, materials, shipping and now labour. These factors are translating into project cost increases in the order of 30–40 per cent, which are ultimately delaying final investment decisions.

All these challenges ultimately reflect additional risk and cost to projects. Meanwhile, we observe that the national policy 'pull' for renewable electricity projects has diminished. Australia's RET of 33,000 GWh per annum has now been comfortably achieved, and demand for new large-scale generation certificates is now being largely supported by voluntary demand from the private sector. Voluntary demand is expected to grow over the coming years; however, the rate of such growth is less certain than demand incited by a mandatory obligation.

This national policy vacuum is having an impact on investment today. Assuming that it requires in the order of two years to construct a wind farm and typically 12–18 months for large-scale solar, projects committed in 2023/2024 will not begin generating until 2025/26, meaning that the support now being provided by the RET is minimal. The year 2030 now represents the 'near term', and a clear long-term policy framework is urgently required to pull through investment in these long-life major infrastructure assets that will underpin the decarbonisation of our electricity systems and economy more broadly.

While State Government schemes such as reverse auctions have been helpful, these support mechanisms are typically (with the exception of NSW) more modest in scope and less predictable for investors in providing support for their projects. (For example, New South Wales is the only state to have released a long-term forward schedule of tenders.) They are therefore less efficient at incentivising the broad-based investment that a simpler market- or economy-wide mechanism would stimulate, such as a carbon price or certificate surrender obligation on retailers.

There are a number of policy options that could be considered by the Australian Government to catalyse new investment, including an extension to the LRET or the establishment of a national contract for difference scheme.

Given the efficacy and efficiency of the Renewable Energy Target, which drove unprecedented investments in Australia's electricity grids between 2017 and 2020, the CEC considers that the simplest policy intervention would be to extend the existing RET architecture and increase its level of ambition. Employing a mechanism which is well-understood by the market would help to minimise investor uncertainty about untested policies, which could in turn have a further chilling effect on investment.

An increased, legislated target would accelerate large-scale generation investment and deployment in the following ways:

1. Motivating offtake and new power purchase agreements to be struck.
2. Reducing complexity for investors in navigating multiple state incentive schemes.
3. Providing greater investor certainty about the volumes and timing of renewable energy generation required, reducing investor risk and therefore the cost of finance for building capital-intensive, long-life renewable energy assets.
4. Providing clear signals to supply chains about the volumes and timeframes for the necessary equipment, and enable Australian projects to secure more favourable pricing.

By reducing the cost of capital and the cost of equipment, which are the two largest expenses of renewable energy projects, we expect that the scheme would materially assist Australia to lower the cost of electricity to consumers, and of the energy transition more broadly.

It would also assist Australia to begin a meaningful conversation with original equipment manufacturers (OEMs) about locating some new local manufacturing facilities for the renewable energy supply chain within Australia. The lack of a mandated renewable energy target beyond 2030 makes it more difficult to attract interest in building onshore facilities.

The proposal for a RET increase and extension has strong support across the sector. In our recent survey of industry leaders, the majority indicated that an extension of the RET would increase their confidence to invest.

Recommendation 2.11: Provide a long-term national policy mechanism to drive increased and sustained investment in large-scale renewable energy projects and support achievement of an 82 per cent renewable energy share by 2030. The CEC's preferred option is to increase the Large-scale Renewable Energy Target (LRET) and extend it beyond 2030 to at least 2040 as the most efficient and effective option.

2.3 ACCELERATING THE DEPLOYMENT OF ENERGY STORAGE

Utility-scale/bulk energy storage

AEMO's Integrated System Plan identifies that bulk energy storage will be critical to a reliable and secure transition. It finds that approximately 13 GW of new utility-scale storage will be required by 2040–41, up from 1.6 GW in 2023–24, to help firm renewable generation build-out.

Other forms of renewable energy storage will be increasingly critical, as chemical energy storage held in coal and gas reserves is necessarily removed from the power system. Renewable energy storage will be needed to maintain a reliable supply of energy during traditional peak demand times and to carry energy from day to night, as well as to manage seasonal supply tightness – the so called 'dunkelflaute' effect.

A portfolio of renewable energy storage technologies is needed to maintain the reliability and security of the power system. This means utilising the capabilities of better-known technologies, such as batteries and pumped hydro, as well as other LDES technologies, including thermal storage, compressed air and redox flow batteries.

Collectively, these technologies can deliver sustained energy supply, and valuable system services such as inertia, system strength, and frequency/voltage control. Adopting a portfolio approach will therefore help to meet the various needs of the power system at lowest overall cost.

While the promise is significant, renewable energy storage still faces a number of challenges to effective integration. Technologies such as batteries are still relatively new, with industry and operators still determining how they are best optimised. Pumped hydro, while a mature and well-understood technology, is capital intensive and brings its own investment risk profile. Other forms of long-duration storage, such as compressed air, redox flow and thermal, are relatively untested in Australia and may have some way to come down the cost curve.

Coordinated policy reforms are therefore needed to support the rapid uptake of these valuable and critical elements of the transition. The CEC considers that the following policies and reform areas offer an effective way to accelerate the rollout of energy storage in the NEM.

Capacity investment scheme (CIS)

The recently released consultation paper from the Department of Climate Change, Energy, Environment and Water (DCCEEW) sets out many of the elements of the proposed design and operation of the CIS. The CEC has made a detailed submission to the CIS, available **here.**

At a high level, we note that the CIS is currently targeting a 6GW reliability target for dispatchable supply, and this value is defined as a cap. As identified above, storage complements the other elements of the transition. This means storage can help manage any unexpected changes in the levels of available transmission or generation. For example, delays in new transmission investments or major renewable projects, or earlier than expected exit of thermal coal generation, can be at least partly managed by bringing forward investment in additional storage.

The CIS targets should be flexible, to enable the bringing forward of additional volumes of storage, in the face of these kinds of unexpected events. On this basis, we recommend that the 6 GW target be set as a floor, rather than a cap. This will allow for additional storage capacity volumes to be brought forward as necessary.

Beyond this, issues arise regarding the timeframes associated with the CIS. Currently, the CIS targets a timeline of 2030. These timeframes will tend to crowd out longer lead time assets like pumped hydro, or alternative storage technologies that have not yet come down the cost curve to the same extent as lithium battery technology. The risk is that the many valuable attributes of these technologies – such as cycle capability, long-duration supply and provision of system security services – will not be captured for consumers.

We also recommend that the CIS be designed to support the deployment of emerging bulk energy storage technologies in addition to mature storage options. This could be achieved through partitioning some portion of the CIS funding or otherwise recognising the particular reliability benefits of some of these alternative forms of long-duration energy storage.

We also recommend that the Government retains scope to iterate and develop the design of the CIS to reflect the rapidly changing technological, commercial and regulatory environment. Design choices, such as minimum duration requirements and relationships with contracting processes, must be made with this principle in mind.

Addressing the specific risk profiles of different storage types

Given the issues identified above, government can also support delivery of a storage portfolio through underwriting or more direct forms of support, such as grants and concessional finance.

We consider that this kind of support should be targeted at technologies such as pumped hydro, as well as the many forms of emerging LDES technologies.

Pumped hydro assets face particular risk profiles. As high capex, long lead time assets, pumped hydro faces risks related to supply chain, construction and geological issues. However, pumped hydro can play a unique and important role in the transition, given its long life, synchronous functionality, ability to repeatedly cycle and its deep storage capabilities. Policy makers should look to address these particular risk profiles, potentially by developing underwriting schemes that are tailored to managing these specific risks.

Similarly, alternative LDES technologies, such as flow batteries, compressed air and thermal energy storage, have great potential, but are not well established in Australia. Government underwriting will help industry develop these technologies, which will deliver a lowest overall cost transition for consumers.

Connection, commissioning and technical requirements

As mentioned above, the CEC and AEMO have worked together to progress the CRI, which will help accelerate the deployment of generation and storage. However, challenges remain that apply specifically to storage. For example, developers are currently disincentivised from connecting a battery to an existing wind generator, as this creates new risks for the existing asset. Other issues arise when battery operators are looking to upgrade their assets to provide valuable grid-forming services.

Both of these issues continue to be progressed through the CRI. The CEC would welcome the opportunity to brief Ministers and officials on industry perspectives as to the direction of these particular reforms.

Another key enabler of storage relates to the technical standards that define their capabilities. Currently, these standards do not give adequate consideration to the grid-forming capabilities of batteries, which could go a long way to delivering a more robust and secure power system. Governments should encourage AEMO and the Australian Energy Market Commission (AEMC) to accelerate work to properly account for these capabilities.

AEMO and the AEMC must also focus on ensuring that storage investors are properly remunerated for the valuable services they bring to the power system. The CEC recommends that governments direct AEMO, the AEMC and the Australian Energy Regulator (AER) to develop regulatory processes that do not simply mandate that generators deliver capabilities – such as grid-forming capability, primary frequency response and voltage support – without proper remuneration. This will only increase the cost and complexity of investing in these critical assets, which will result in higher prices for consumers.

Recommendation 2.21:

In regards to the CIS, the CEC recommends that:

- **The 6GW target be set as a floor, rather than a cap.** This will allow for additional storage capacity volumes to be brought forward as necessary.
- **Timeframes for the CIS be extended, to recognise the storage volumes that will be required out to 2040 and 2050,** and that different storage technologies have different risk profiles and lead times for delivery.
- **The CIS be designed to purposefully encourage a mix of technology solutions,** by either partitioning the scheme itself, or explicitly valuing the specific capabilities of different technologies.
- **Flexibility be purposefully designed into the CIS,** allowing the scheme to flex to account for a rapidly changing technological and commercial environment.

Recommendation 2.22: Governments should direct the AER, AEMC and AEMO to focus their work around developing techno-regulatory frameworks that explicitly recognise and value the capabilities of energy storage, and avoid simply mandating capability through regulatory standards.

Distributed solar and storage

Australian households have played a large and important role in driving the decarbonisation of our electricity system. This will need to continue if we are to meet our net zero goals by 2050 and the growing demand from the phase out of oil and gas in transportation and buildings.

To date, Australians have invested approximately $20 billion in the energy transition by putting solar PV systems on their rooftops. Homes within the NEM now boast over 17 GW of capacity coming from rooftop solar. Total rooftop solar PV installed capacity in the NEM will need to climb to 37 GW by 2030 and 55 GW by 2040 in order to align with AEMO's Step Change scenario.

On its own, solar generation is a passive form of generation and there is a limit to its value. Storage, however, makes this passive generation source more flexible and valuable to both the individual and the wider system.

AEMO predicts that an efficient and effective integration of distributed energy to our energy system can unlock almost 30GW of distributed storage and flexible demand. These findings assume that the investment made in distribution systems will be coordinated with distributed energy expansion for efficient operation and export.

A recent study by Energy Consumers Australia and CSIRO[11], supported by the Clean Energy Council and other organisations, found that a combination of rooftop solar and batteries are an effective complement to household electrification, enhancing the projected annual savings to consumers. Fully electrified households that can install rooftop solar and a battery are forecast to save a further $1250 per year by 2030, and $1420 by 2040 on top of the savings from fuel switching.

[11] Stepping-Up-Report-Final.pdf (energyconsumersaustralia.com.au), August 2023

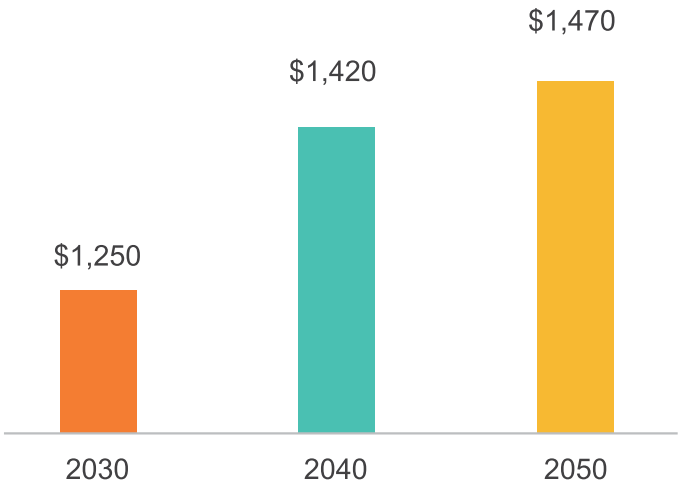


Figure 4: Additional electrification savings available to some households as a result of solar and battery ownership (Energy Consumers Australia, August 2023)

Rooftop solar and battery storage also enjoy the advantages of being relatively efficient to deploy (i.e. not requiring permitting), being able to utilise a distribution network that enjoys ample spare capacity for much of the year, and by providing insurance value against blackouts caused by natural disasters.

However, battery storage remains expensive, and this acts as a barrier to deployment levels that means the full value of its benefits are not attained. AEMO's Step Change scenario forecasts that distributed battery storage will grow from less than 1 GW in 2022 to over 6 GW in 2030. However, we note that this forecast has been predicated on a 50 per cent capital subsidy for battery storage that does not currently exist[12], and so is highly unlikely to be realised without policy intervention.

Options for driving greater uptake of distributed batteries

One strategy for promoting the stronger uptake of small-scale battery installations is the expansion of the SRES scheme to capture both battery installation as well as batteries that participate in orchestration services. This intervention could be introduced quickly via regulatory (rather than legislative) changes and could go some way to accelerating the roll-out of small-scale batteries for households and businesses. The Government could also consider whether such a scheme could be leveraged to support electric vehicle uptake, subject to particular criteria being satisfied for vehicle-to-grid home charging availability and capability.

We note that the retention of the SRES scheme beyond 2030 would also provide benefits for safeguarding quality and safety standards associated with rooftop solar and storage installations, as well as future-proofing energy resilience for households and businesses.

The CEC acknowledges that such a proposal would need to be subject to a detailed analysis of the costs and benefits to consumers at varying levels of support. We would be pleased to work with the Government to explore the range of options available, to ensure that the distributed energy sector is set up for success to deliver its necessary share of the 82 per cent target.

Prioritising a co-ordinated work program for rewarding distributed solar and storage

Further, to achieve AEMO's forecasts we need to ensure solar generation and storage policy reform is nationally co-ordinated and that it drives outcomes whereby owners of these assets are rewarded for participating in the wholesale market and ancillary services markets, and that networks pay for access to solar generation and storage for network services through nationally consistent charging and accessing arrangements.

[12] Green Energy Markets report for AEMO (June 2021), Final 2021 Projections for distributed energy resources – solar PV and stationary energy battery systems

The Energy Security Board (ESB) has previously coordinated a policy response to the evolving distributed energy industry through the CER Implementation Plan. It is critical that the Federal Government does not lose sight of the requirement for continuing national co-ordination of the numerous workstreams in the CER Implementation Plan. As such, we recommend that the CER Implementation Plan becomes a standing item on the Energy and Climate Change Ministerial Council (ECMC) Meetings.

The work the ESB undertook with KPMG this year to identify priority gaps in the CER Implementation Plan resulted in a report that will serve as the foundation for any future CER program of work. We recommend that the KPMG report is published as a draft for consultation and industry feedback is sought. Through our participation in the ESB's consultation processes, we are aware of a range of different views, which are not necessarily well aligned with the draft conclusions presented to market participants just prior to the formal winding up of the ESB. For example, CEC members and other stakeholders believe the focus on developing backstop mechanisms by distribution networks in response to solar generation during the day has been placed ahead of the importance of developing viable markets for CER to participate in and be rewarded.

Recommendation 2.23: Set a national rooftop solar target for 2030 and 2040, reflecting the Step Change scenario.

Recommendation 2.24: Set a national distributed energy storage and flexible energy target for 2030 and 2040, reflecting the Step Change scenario.

Recommendation 2.25: Support distributed battery installation uptake including an expansion of the SRES, which will enable Australia to better exploit the immense value of rooftop solar, and support a more flexible and resilient system.

Recommendation 2.26: Prioritise the national co-ordination and delivery of the CER Implementation Plan to reward rooftop PV and storage for participation in wholesale markets and ancillary services markets, and that networks pay for access to solar generation and storage for network services through nationally consistent charging and accessing arrangements.

2.4 SUPPORTING EMERGING FORMS OF LARGE-SCALE RENEWABLE ENERGY GENERATION

Large-scale solar and onshore wind are the lowest cost form of renewable electricity today, but other forms of large-scale renewable energy generation have the potential to play an important role in a much larger, decarbonised energy system.

The leading prospect among these is offshore wind, which has moved rapidly down the cost curve in the United Kingdom and Europe with strong government support, and has already attracted strong investor interest in Australia.

While offshore wind is more expensive than onshore wind generation in Australia today, it offers a complementary generation profile and the opportunity for very large-scale developments, which will otherwise be increasingly difficult to accommodate over time within reasonable proximity of major load centres. This is where offshore wind comes into its own.

Offshore wind

Australia's offshore wind industry is developing at a rapid rate of knots. As recently as two years ago, the country did not have enabling legislation for the emerging sector, and Australia was home to none of the 64 GW of globally deployed offshore wind.

Fast forward to now, and we have a well-considered legislative framework, a range of key regulations either finalised or in development, and four offshore wind area declarations that are either complete or drafts open for consultation, with the Federal Government set to declare a final two by November. Victoria has been leading among State Governments, committing to reaching 9 GW of operational offshore wind by 2040, with interim targets along the way, backed by a series of Implementation Statements that outline the work they are doing towards that goal.

More than 100 GW of projects have been publicly announced across Australia, with many more in development. The feasibility licence application round in Gippsland elicited 37 applications. This is significantly more than the declared area can accommodate, but it is a demonstration of the serious interest in Australia's offshore wind market.

This investor and developer interest is built on the high quality of Australia's offshore wind resource – thousands of kilometres of coastline with average wind speeds above 8 metres per second – but has benefited from the market need for significant growth in renewable energy as coal generators retire and positive signals emerging from Federal and State governments on the future of offshore wind in Australia.

Despite the promising progress made in recent years, there is still much to do given the offshore wind industry in Australia will need to be built from scratch.

Some of the critical gaps that currently exist include:

- **Definition of a national target for offshore wind, supported by a supporting policy mechanism to underpin contracting:** The development of the offshore wind sector would benefit greatly from the establishment of a national offshore wind target, which would provide a clear signal to investors about the level of ambition and associated timeframes for the development of the Australian market. Such a target would also assist to anchor the associated infrastructure planning.

- This target would need to be supported by a policy support mechanism to underpin contracting of offshore wind energy. The mechanism will need to reflect the current market conditions, and have sufficient flexibility to ensure projects can be delivered even in the case of significant market impacts.

- **Port capabilities to support construction and delivery of offshore infrastructure:** Offshore wind farms will require a significant expansion of port capacity. The volume of components required to build a turbine, in addition to the supporting installation vessels required cannot be accommodated without major upgrades at strategically chosen ports.

- The Australian Government should lead the development of a national ports strategy, which considers Australia's port network as a whole and the demands that will be placed on it as a result of growing and emerging clean energy markets, including the offshore wind sector.

- **Upgrades to transmission capacity:** Most proposed offshore wind farms in Australia are very large – the majority are over 1 GW, with many aiming to go beyond 2 GW in capacity. The geographic concentration of even a small number of these large projects means it will be necessary for governments to play a role in planning and delivering new or upgraded transmission capacity. Coordination is required to help avoid a patchwork of project-specific transmission lines and prevent delays in connecting offshore renewables into the grid helping to minimise the onshore social and environment impacts of the industry.

- **Lack of construction vessel availability:** While construction of Australia's first offshore turbines is still some years away, there are already concerns across industry relating to the availability of appropriate construction vessels – some offshore wind installation vessels are already booked up until 2030. With many other global markets also setting ambitious targets for offshore deployment, competition for the limited fleet of construction vessels is tight. As part of the proposed National Clean Energy Supply Chain Strategy **(see Section 3.4)**, the Government could provide incentives/financial support to ensure dedicated installation vessels are available to meet anticipated domestic needs. This could include providing security against vessels for set charter periods when installation operations are expected to commence.

- **Investment and coordination of baseline environmental research:** The process for area declarations and feasibility licence assessments creates very tight timeframes for the environmental studies needed to support the eventual approval of offshore wind farms. Given that successful proponents for each area may not be known for some time, this is causing delays in the required research to commence. The Federal Government could play a role in supporting baseline environmental studies at the scale of each declared area (or potentially declared area) to reduce the time needed post-feasibility licence for projects to proceed to construction.

Recommendation 2.31: Set a national offshore wind target to provide investor certainty in relation to the scale and ambition of Australia's offshore sector, supported by a policy support mechanism that can drive contracting.

Recommendation 2.32: Lead the development of a national ports strategy, which considers Australia's ports network as a whole and the demands that will be placed on it as a result of growing and emerging clean energy markets, including the offshore wind sector.

Recommendation 2.33: Provide targeted support and co-ordination for transmission enhancements to service key offshore wind zones.

Recommendation 2.34: Introduce incentives or financial support to ensure dedicated installation vessels are available to meet domestic needs.

Recommendation 2.35: Provide government support for environmental analysis of declared offshore wind regions, specifically co-ordination of regional marine baseline studies to ensure optimisation of niche research resources and avoid delays to projects waiting on required environmental studies.

2.5 A ROBUST AND RESILIENT TRANSMISSION NETWORK

Transmission infrastructure is the third vertex of the triangle, outlined in the introduction to Section 2, and is the natural complement to storage and generation. While storage moves energy through time, transmission moves it through space. This will become increasingly important as the system moves to higher penetrations of variable renewable generation.

Transmission supports technical diversity (i.e. a mix of wind, solar and hydro) and a geographic distribution of renewables, both of which contribute to maintaining a reliable supply of electricity at lowest cost.

Significant investment is required in transmission to deliver an efficient transition. AEMO estimates that more than 10,000 kilometres of new transmission infrastructure will be required by 2050. It is likely that significant opportunities also exist to augment and upgrade the existing network, to further increase hosting capacity for renewables.

Storage and generation can also be used to ensure we get greater utilisation of transmission assets, by acting as 'shock absorbers' to protect against major events. Storage can also allow energy generated during the day to be stored and moved through transmission lines at night, further increasing utilisation and value for consumers.

Coordinated policy reforms and government support for reforms already under way can assist in accelerating the build-out of necessary transmission. Here, we focus on regulatory, economic and technical issues, as well as overarching co-ordination and the importance of strengthening social licence for transmission augmentation projects.

National co-ordination of transmission upgrades

Australia, and particularly the NEM, is currently playing catch-up on the necessary transmission augmentation after a decade of insufficient planning and investment. The infrastructure investment will require a large and sustained effort over many years (indeed decades) by many different parties working across multiple projects and regions.

The CEC believes that a co-ordinated national delivery plan for all transmission projects of national significance could assist to deliver cost and time efficiencies. Greater co-ordination could support increased bundling of large equipment orders to reduce costs and long-wait times, and enable co-ordination of works scheduling to maximise Engineering, Procurement and Construction (EPC), plant and workforce availability.

AEMC harmonisation rule changes

Energy Ministers have recently submitted a package of rule changes to the AEMC to harmonise the existing electricity, retail and gas rules with the new emissions reduction objective in the National Energy Objectives. The AEMC has moved quickly to commence a series of rule changes, and the CEC is committed to working closely with the AEMC to support these rule changes. We look forward to improvements to the Regulatory Investment Test for Transmission (RIT-T) and the Integrated System Plan (ISP) processes, to more accurately and directly account for the full extent of carbon impacts, when assessing large and small-scale network augmentation.

We have also encouraged the AEMC to consider how reliability of supply can be made more resilient to the effects of climate change, by revisiting the way that the economic tests are applied. This is a key way that the effects of climate change can be adapted to, markedly enhancing reliability. Ministers should give direction to the AEMC to consider how network planning and investment processes can be made purposefully resilient to the impacts of climate change.

Effective utilisation of non-network solutions

The CEC considers there is great opportunity for the competitive energy generation and storage sector to work effectively with regulated network businesses, to co-ordinate storage and transmission buildout. This can be effectively achieved through enabling non-network solutions, sometimes referred to as virtual transmission. As exemplified by the Victorian and South Australian big batteries, as well as the Riverina/Darlington Point battery, storage assets can play a key role in reducing the costs and improving the utilisation of networks. These solutions can often be rolled out much faster than network build and often at a lower cost for consumers.

However, while some networks are adopting these solutions, challenges remain. Issues around the ability of networks to recover costs and arcane rules around the economic assessment of costs and benefits are currently creating challenges for Transmission Network Service Providers (TNSPs) to adopt these solutions.

The CEC is well-positioned to work with industry and network businesses, as well as our colleagues at Energy Networks Australia, to explore how these issues might be addressed. As discussed below, we would welcome the opportunity to collaborate with Ministers and officials to develop industry-accepted models supporting non-network solutions.

Circular transmission planning – responsive planning processes and access to meaningful information

Network planning is currently a top down process, where central planning through the ISP feeds into transmission annual planning reports and then down into individual project regulatory investment tests. While this approach has benefits, it ignores the significant opportunities that arise from a more responsive approach to network planning. In some cases, this has led to a misalignment between generation and transmission build, resulting in unnecessary and wasteful spillage of energy from already-built generation assets.

A better approach would involve TNSPs proactively planning their networks to co-ordinate with generator developers, rather than relying on central planning to determine where new generation should be located. The collective commercial drivers of individual developers can be a powerful tool for identifying the parts of the grid with the best renewable resource and available network, and therefore where the lowest cost opportunities exist for developing new renewable generation.

Responsive planning also entails the provision of more detailed and useful information to generation developers. The CEC supported several members who proposed a model to the ESB, which would have required network service providers to publish detailed forecast 'hosting capacity' projections for their networks. The ESB did not adopt this approach, however, we consider it would go a long way to ensuring the most efficient utilisation of network capability.

A collaborative approach to deliver industry accepted reforms

The CEC considers that many of the issues identified here are best addressed through reform processes that actively include the clean energy industry. This can leverage the applied commercial and technical knowledge of industry, to deliver reforms that are practical and can be implemented at speed.

The CEC has demonstrated what this looks like through the CRI. The CRI is an ongoing reform process involving extensive collaboration between industry, networks and AEMO, to identify pragmatic solutions to issues with the connection process. The CRI has been effective because it gives investors, operators and technology providers an equal seat at the policy-making table. This results in more developed and practical policy, as well as faster implementation.

The CEC would welcome support from Ministers to help replicate the success of the CRI. A small amount of funding from Government would go a long way to enable targeted policy projects around non-network solutions and delivery of a circular planning process.

Concessional financing to manage transmission blackspots

A key issue that has been identified in the transmission frameworks relates to the so-called transmission black spots. These are parts of the transmission network where network augmentation has not kept pace with renewable investment, resulting in significant curtailment of otherwise valuable energy.

Government can help resolve these black-spot bottlenecks by supporting build out of critical infrastructure. This can be enabled through the targeted provision of concessional finance. This could involve supporting investment in both network and non-network solutions.

Strengthening social licence for transmission projects

As discussed in further detail in Section 3.1, the renewable energy sector has invested considerable effort and resources over the past decade in raising the standard of community engagement practices and community benefit sharing, with the aim of renewable energy projects being valued contributors to the economic and social wellbeing of regional communities. We recognise that this is a journey of continuous improvement and the Clean Energy Council is committed to working with the industry and our stakeholders to ensure the sector continuously meets community expectations.

This same effort will be just as important for the transmission sector whose impacts in regional communities could be just as significant over the course of the energy transition.

We welcome the announcement of a review by the Australian Energy Infrastructure Commissioner into community engagement practices related to the deployment of renewable energy infrastructure, including transmission, and look forward to engaging constructively with the Commissioner on approaches to strengthen the social acceptance of energy infrastructure investment in communities. We note that the Rewiring the Nation fund can help support more detailed community consultation in the early planning stages of new transmission lines and that the AEMC is currently considering a rule change relating to how TNSPs carry out community engagement.

A key differentiator between renewable electricity generation/storage projects and transmission projects has been the compensation arrangements for the hosting of infrastructure, with wind/solar/energy storage hosts having typically received more attractive compensation arrangements than those of transmission hosts.

We are pleased to see that recent reforms by Queensland, New South Wales and Victoria have sought to address these inequities with a commitment to substantially increase landholder compensation payments. We expect that other states will need to follow suit.

Renewable Energy Zones (REZs) provide an opportunity for the communities that host transmission and generation infrastructure to also benefit from broader community benefit-sharing schemes, which should deliver an enduring positive impact not only to directly-impacted landholders but also surrounding districts.

Recommendation 2.41: Evaluate the benefits of a co-ordinated national delivery plan for all transmission projects of national significance to deliver cost and time savings.

Recommendation 2.42: Ministers to provide the AEMC with explicit instruction to consider the benefits of enhancing network resilience to the effects of climate change, through the NEO Harmonisation rule changes.

Recommendation 2.43: Ministers to provide funding for the CEC to lead an industry collaborative approach to enable non-network solutions and to develop a circular planning model.

Recommendation 2.44: Ministers to direct concessional financing towards addressing 'blackspots' on the transmission network.

SECTION 3: KEY ENABLERS OF OUR CLEAN ENERGY TRANSFORMATION

The transformation of Australia's electricity system over the next two decades depends on a range of enabling factors that can fundamentally help or hinder the speed at which Australia can mobilise investment.

This section provides a broad analysis of the key enablers, and recommendations for ensuring that these key aspects of the transition receive the strategic planning and resources they require:

1. Strong social licence for the clean energy transition
2. Efficient planning and environmental assessments process
3. Building a large, skilled and diverse workforce
4. Robust supply chains

3.1 STRONG SOCIAL LICENCE FOR THE CLEAN ENERGY TRANSITION

Securing and maintaining community support for the clean energy transition is essential. Any major economic or industrial change will proceed more smoothly and efficiently if communities are supportive. While many Australians have already chosen to install solar panels on their own roofs, large-scale projects typically involve greater change in the landscape.

At a high level, the emerging social licence challenges for large-scale projects are in part due to the success of the industry: more projects are being built and developed, meaning more people and communities are coming into contact with these projects. The creation of REZs means an increasing geographic concentration of projects. This makes sense from the perspective of economic efficiency of investment in network infrastructure, but it inevitably also creates a geographic concentration of impacts: more communities will deal with multiple nearby projects, which can lead to a range of cumulative impacts on communities and the environment.

At the scale of individual projects, communities raise a range of concerns. Some of these include:

- Visual impacts
- Concern that the use of agricultural land (especially for solar farms) will reduce agricultural production in a region, affecting its character and potentially the viability of food processing facilities
- Environmental impacts. These are usually greater for wind farms, primarily due to impacts on bird/bat populations and the fact that wind speeds are typically higher along ridge-lines or on hills, which are less likely to have already been cleared for agricultural production.
- Noise pollution
- Concern about end-of-life and how projects will be decommissioned and materials recycled
- Confusion/stress on landholders when having to deal with legal agreements with energy companies, sometimes with multiple companies interested in the same land.

By and large, these issues are being effectively managed, but if left unaddressed in specific circumstances, these types of concerns will start to erode community support for renewable energy. To some extent, levels of concern may be temporary: data recorded by the Australian Energy Infrastructure Commissioner reveal that the vast majority of public complaints received by his office are for proposed projects – just five out of a total of 87 complaints received in 2022 were in relation to operational projects[13]. This supports the position that there is greater community acceptance of renewable energy projects once they are built. However, there are still many proposed projects, and there will continue to be large numbers of proposed projects in order to ultimately achieve government targets for the energy transition.

[13] Australian Energy Infrastructure Commissioner: 2022 Annual Report

Some of the solutions that need to be consistently pursued to improve and maintain social licence include:

High quality community engagement: while good community engagement is not a guarantee of community support for a project, project developers who invest in building relationships, operate with transparency and listen (and respond) to community input are more likely to avoid community opposition that can lead to major project delays. We note that community engagement practices across the renewable energy sector have matured over the past decade and there is a strong commitment among the CEC's membership to engage respectfully with local communities including Traditional Owners of the land in developing and operating renewable energy projects. This commitment is set out within the **CEC's Best Practice Charter for Renewable Energy Projects**, which has more than 50 signatories across the sector.

Effective benefit-sharing programs, including possible pooling of funds between projects: Most wind and solar farms have established community benefit funds – a way of contributing profits from the project directly to the host community and those most impacted by the project. As described by the Clean Energy Council's **Guide to Benefit Sharing Options for Renewable Energy Projects**, these programs are most effective when designed in close collaboration with the community, to ensure that the funding stays close to where the impacts are greatest and goes to projects of most importance to that community. There is growing interest across the industry for exploring ways of pooling these benefit-sharing schemes across multiple nearby projects. The primary benefit of this is that one larger fund might be able to support initiatives that are more transformative for the community than might be possible with a larger number of small funds, though it is also important that the benefits of a given project remain close to where the impacts of the project are.

Involving First Nations people and communities: Registered Aboriginal Parties, Traditional Owner groups and First Nations people are important partners in any renewable energy project, and we should seek to lift the bar on their involvement to ensure First Nations communities are beneficiaries of the energy transition. Involvement can take a range of forms, such as: closer and earlier engagement in consultation on project design; both direct employment and the opportunity for First Nations-owned businesses to supply goods/services to projects; benefit-sharing schemes, alongside other community benefit funds, and exploring options for First Nations equity stakes in projects. The CEC, in partnership with the First Nations Clean Energy Network and KPMG, is in the process of developing a guide for industry to support better First Nations engagement, participation and benefit sharing. The Guide aims to help the industry put into practice measures that deliver on the best practice principles for clean energy projects as developed by the First Nations Clean Energy Network[14]. The CEC will regularly review the Guide to ensure it is kept up to date as practices evolve.

Coordination of project construction to reduce disruption to communities: Projects trying to build at the same time in similar geographic areas can create strains on communities. For example, construction workers might take up all available accommodation in the region – ostensibly a positive, but making it difficult for visitors to find accommodation, which affects businesses that are dependent on tourism; tradespeople in the area might take on work for the wind or solar project, making it much harder for residents to find an electrician to do work on their house; the transportation of wind turbines and blades can lead to rolling local road closures. Region-specific work to understand how each of these, and other, factors might play out when multiple projects are trying to proceed at the same time would be valuable. Ideally this leads to coordination between projects that simultaneously creates a smooth process for those projects and also reduces disruption to communities – a win-win.

Role for government in promoting the importance and benefits of REZs: By creating REZs that create a geographic concentration of energy projects (generation, storage and transmission) in a state, governments have contributed to the concerns of communities that they are now expected to accommodate more renewable energy projects than perhaps anticipated. Individual project developers obviously need to take responsibility for ensuring high-quality engagement with the community where they are hoping to build. However, State Governments, in particular, need to play a central role in publicly communicating the rationale for the creation of these zones and working to ensure community acceptance for the changes that will come to these regions.

[14] Aboriginal and Torres Strait Islander Best Practice Principles for Clea Energy Projects - link

Incentives for innovation in project design and delivery: Good project design can help avoid many of the impacts that communities are concerned about. For example, agrisolar is the concept of using the same piece of land for both solar power production and agricultural production (often as sheep grazing under panels, but increasingly looking towards horticulture options). Other ideas for innovative project design include regenerating native vegetation (and soil carbon) under solar panels, or partnerships with Landcare groups for local conservation efforts – either onsite or adjacent to wind/solar farms. These types of innovative approaches are typically more difficult and may require more upfront cost with less certainty that this investment might be recovered. The Federal Government could create an incentive for project proponents to push the boundaries of innovative project design and delivery by establishing an annual prize or competitive funding round awarded to the most creative or 'net positive' projects.

Recommendation 3.11: Industry and governments should partner to jointly develop a best practice framework for community benefit sharing for large-scale generation, storage and transmission projects to ensure that host communities, including farmers and First Nations, enjoy the benefits of Australia's clean energy transformation.

Recommendation 3.12: State Governments, supported by the Federal Government, should develop comprehensive programs to clearly communicate the importance of Renewable Energy zones, and renewable energy projects to communities in these areas.

Recommendation 3.13: Federal and State governments should jointly fund REZ Readiness Plans that assess local capabilities (e.g. Business capacity to support/supply projects, accommodation availability, skills/training needs), regional logistical constraints and community needs, to identify barriers and solutions to ensure smooth project deployment in each REZ and a reduction in disruption to local communities.

Recommendation 3.14: The Federal Government should create the Prime Minister's Prize for Renewable Energy Innovation. This major funding round or competition would fund innovative utility-scale projects (not pilots) that demonstrate and measure how renewable energy can be deployed in ways that are "net positive" on their local environment. Funded projects should identify the incentives and reforms required to ensure these approaches and practices can be adopted commercially in the future.

3.2 EFFICIENT PLANNING AND ENVIRONMENTAL ASSESSMENTS PROCESS

No renewable energy project can go ahead without planning and environmental approvals – the processes around each of these are therefore critical to the success of the energy transition. While State Governments typically lead on planning and environmental assessment processes, the Federal Government retains an important role through its implementation of policies and guidelines that exist under the framework of the Environment Protection and Biodiversity Conservation Act 1999.

There is no shortage of developer and investor interest in potential projects. The Registrations of Interest for NSW Renewable Energy Zones is a clear demonstration of this, with most REZs receiving registrations equivalent to around ten times more megawatts worth of projects than there is planned hosting capacity within the REZ. Another example is the nascent offshore wind sector, with 37 applications for feasibility licences in the Gippsland area, even though, by area, it could only accommodate a theoretical maximum of perhaps 12 projects (and even fewer based on proposed transmission capacity).

Despite this interest, it is a long runway from project proposal to gaining planning permits and a grid connection. As outlined earlier in this submission, recent analysis for the CEC finds that, each year from 2026 for the remainder of this decade, we need 5.4 GW of wind capacity and 1.5 GW of utility-scale solar capacity (in

[15] Note that a minority portion of this required capacity in future years has been committed. See the Green Energy Markets report in the Appendix for a detailed overview of the generation and capacity requirements, commitments to date, and remaining 'gap' to 82 per cent.

addition to 3.6 GW of rooftop PV)[15] to come online in order to hit Australia's 82 per cent renewable energy target. With the significant timeframes between securing a planning and environmental approval for a project and ultimately commissioning that project, we need to ensure that the planning and environmental assessment systems are geared up now to enable this rate of deployment.

Obviously COVID-19 has played a role in recent years in affecting the pace of project development and approvals. However, a few other key factors are at play in most Australian jurisdictions, including:

- Increasingly complex requirements for planning processes
- Tightening environmental protections
- A growing wave of litigation against projects
- 'Low hanging fruit' of the easiest/best wind/solar sites already taken, meaning new projects are more affected by constraints
- Resourcing limitations within government departments and agencies

Some of these issues are more pronounced in some jurisdictions than others.

Steps that would help create more efficient assessment processes are outlined below.

1. **Creating predictable assessment pathways:** Predictability of both process and timelines are valued highly by developers and investors. Assessment teams in planning departments across the country would benefit from additional human resources dedicated to reviewing applications for renewable energy projects. Similarly, referral agencies such as environment/biodiversity agencies, transport agencies and fire services would be better placed to respond to the growing volume of work required to progress the applications of renewable energy projects with additional staff focused on prioritising assessments of these projects. Greater coordination of assessments within government would also help ensure more consistent and predictable process, using a concierge or case-management style approach to handling each project application.
2. **Upfront regional environmental assessments:** Many projects are held up by the need for detailed, lengthy, site-specific environmental assessments. With the creation of REZs, there is an opportunity to front-load some of the environmental assessments at a regional scale. This will serve two key purposes: firstly, it will allow each individual project to produce fewer studies of its own (and therefore progress more quickly) because more will already be known about the environmental constraints in the region that are likely to be affected by renewable energy; secondly, the information gathered in these baseline studies will help project developers avoid sites considered by government to be higher ecological risk, ideally expediting assessments in areas considered to be lower/medium risk. This type of assessment needs to be combined with analysis of other factors that influence site selection, such as resource quality and proximity to network infrastructure and load centres.

Recommendation 3.21: The Commonwealth, state and territory governments need to build additional capacity within their planning and environmental assessment units and referral agencies in order to expedite assessment processes and provide transparency and clarity to projects as quickly as possible.

Recommendation 3.22: Governments can support efficient project development by undertaking region-wide environmental and social assessments of prospective renewable energy zones/regions, which will help direct development activity to suitable areas and reduce upfront costs and overall development timeframes for proponents.

3.3 BUILDING A LARGE, SKILLED AND DIVERSE WORKFORCE

Research from **Net Zero Australia** has found that **decarbonising our domestic energy system** requires the energy workforce to double by 2030 and double again by 2035, with up to 75 per cent of jobs in regional areas. This represents a five-fold increase in the size of the energy workforce, increasing from ~50,000 workers today to **~250,000 workers**. The story is much larger however in a superpower future. The hydrogen superpower potential alone would require a further **~500,000 workers to 2060 across the hydrogen supply chain**, including electricity generation, hydrogen production, transport, storage, and conversion to energy carriers such as ammonia. This does not include a range of other value-added manufacturing opportunities (e.g. green iron/metals production and a larger role in critical minerals processing) associated with the superpower opportunity.

Achieving renewable energy superpower status would involve a transformational shift of Australia's workforce, which would need unprecedented planning, coordination and cooperation between governments, education and training providers, industry, unions, communities, and workers. In the immediate term, the clean energy industry is already facing several workforce challenges that risk Australia's ambitions of 82 per cent renewable electricity by 2030.

Current issues facing the clean energy workforce

The clean energy industry is currently experiencing acute worker and skills shortages, particularly in critical occupations such as engineers and electricians. Existing and worsening skills shortages are the result of multiple factors:

- **Visibility** – Jobs in clean energy jobs and pathways to work in the industry are poorly understood, with most workers side-stepping from other industries. Consequently, the industry has low participation of workers under 30.
- **Location** – The regional location of most jobs is a major impediment to attracting qualified graduates, who are typically attracted to metropolitan areas. The growing size and scale of clean energy projects is pushing siting to increasingly remote areas. Many regions are currently experiencing functionally full employment, with shortages of both skills and workers across multiple industries.
- **Training** – The clean energy industry is suffering from a critical lack of training capacity, notably in electrical trainers. These issues are amplified in regional communities, which are thin education markets and suffer from a lack of facilities and equipment. A slow and unwieldy vocational education and training (VET) system has been a brake on the development of relevant and meaningful qualifications for electrical and mechanical tradespeople in renewable energy. Australia's enduring science, technology, engineering and mathematics (STEM) crisis threatens clean energy project developments, which rely heavily on STEM-based skills.
- **Mobility** – Workers currently face barriers to mobility between projects. There are opportunities to increase worker mobility, such as harmonising the required qualifications and training, and enabling the portability of long service leave and parental leave entitlements.
- **Entitlements** – Long-standing policy uncertainty and tight operating margins have meant that the clean energy sector has struggled to compete with more established (and subsidised) sectors – such as oil and gas – on salaries and entitlements[16].

[16] Clean Energy Council. (2022). Skilling the Energy Transition. URL: https://assets.cleanenergycouncil.org.au/documents/CEC_Skilling-the-Energy-Transition-2022.pdf

The clean energy industry is also experiencing headwinds from:

- **A lack of national coordination and strategic sequencing of projects.** This creates boom-bust construction cycles that exacerbate workforce competition between states and regions, increasing costs for developers and consumers due to construction delays.
- **Intensifying domestic competition for skilled workers.** This is due to historic low unemployment, and a record pipeline of large-scale public infrastructure investment. In a superpower scenario, competition will further increase as the clean energy sector competes with emerging industries such as clean manufacturing for workers and skills from the same pool.
- **Intensifying global competition for skilled workers.** This results from escalating global decarbonisation ambitions and the previously discussed large-scale clean energy investment policies and incentives.
- **Uncertainty regarding future demand for renewable energy projects across solar, wind, storage and green hydrogen.** Any expansion of clean industry will create additional demand for renewable energy generation, with further workforce impacts. The ISP's Step Change and Hydrogen Superpower scenarios project NEM capacity will need to increase by factors of four and ten, respectively, to 2050. The Net Zero Australia project found that national generating capacity needs to increase 40-fold to 2050.

Recommendations

The CEC set out a detailed set of recommendations for clean energy workforce development in its **Skilling the Energy Transition Report** in 2022.

With the exception of the CEC's recommendation for an energy transition authority, which is now being established, many of the relevant recommendations still require action – particularly those pertaining to education and training reform. These are urgent priorities for the Federal Government to achieve its interim decarbonisation targets and would lay the groundwork to becoming a renewable energy superpower.

A short selection of the key recommendations contained within the report are outlined below. Please see the original report for the full set of recommendations.

Recommendation 3.31: Revisit higher education funding models to better align them with industry needs. These needs would be informed by mechanisms established to better anticipate workforce needs.

Recommendation 3.32: Work with State Governments to develop credible estimates of future clean energy workforce needs, to enable planning to meet industry needs.

Recommendation 3.33: Work with State Governments to provide strategic support and resources for training organisations to respond to industry needs.

Recommendation 3.34: Enhance the vocational education and training sector's capacity to understand and meet the demands of industry.

Recommendation 3.35: Establish a clean energy skills funding package. The package should offer targeted support for training facilities to upskill regional workers in advance of critical transmission and renewable energy infrastructure development.

Recommendation 3.36: Raise the international profile of Australia as a centre for clean energy expertise, in order to retain and attract relevant professionals, and encourage aspiring young minds into relevant higher education.

3.4 ROBUST SUPPLY CHAINS

An ethical, resilient, competitive and efficient supply chain is critically important to ensuring that the clean energy transition is successful and that it maximises the economic opportunity for Australia while maintaining the sector's social licence.

The energy transition presents an enormous opportunity to develop stronger supply chains, maximising local capabilities and growing our domestic manufacturing capability and capacity. While access to global supply chains will remain vitally important, building increased local manufacturing/processing/assembly capacity will assist to reduce our dependence on international supply chains, which have experienced significant disruptions over the last few years due to the COVID-19 pandemic, the war in Ukraine, and increased regional geopolitical tensions. ESG concerns, particularly around the risks of modern slavery, and changes in legislation around critical infrastructure, have also strengthened the case for local and visible supply chains.

The case for a stronger local supply chain

There are multiple benefits of establishing a local supply chain to support the clean energy transformation and growth opportunities. Firstly, many international supply chains are already stretched and a massive expansion in manufacturing capabilities will be required around the world.

In regional terms, Australia has been a significant market for equipment suppliers in recent years – indeed, the largest market for wind turbine suppliers in Asia Pacific outside of China – and our supply chain demands will dramatically increase over the next two decades as we strive to decarbonise our economy and capture international export opportunities. With the right policy settings and incentives, these high expected volumes can support a commercial case for OEMs to consider investment in Australian-based facilities.

This would also provide a range of other benefits such as:

- providing some insurance against potential future disruptions of international supply chains
- supporting economic diversification
- supporting regional economic activity
- creating new employment opportunities

We note that often the jobs in renewable energy generation projects can be remote, roster-based and short term, which can be challenging for certain cohorts, such as women. Manufacturing jobs, in contrast can be highly skilled, regular, and ongoing.

Australia has renewable energy supply chain strengths that should be drawn upon. The primary of these is an abundance of critical and strategic minerals, such as iron ore, aluminium, rare earths, lithium and cobalt. Historically, Australia has added little value to these minerals, exporting the raw material for processing internationally. The US IRA creates potential markets for Australian manufacturing, especially critical minerals, and batteries, provided we move quickly. Other nations are already looking to capitalise on this opportunity. We discuss this further in **Section 5.**

We also have strong foundations and expertise in solar technology innovation. Examples of Australia's leadership in this include high-efficiency PERC cells (invented at UNSW), developments in printed solar cells (led by CSIRO) and the SolShare rooftop-sharing solutions for apartments (developed by Allume).

In light of growing ESG concerns and the focus being put on the carbon embodied in the clean energy supply chain, Australia has a natural advantage in its abundance of renewable resources and the ability to offer green manufacturing.

Challenges for Australia

However, as a remote developed country with a small population, Australia faces a series of challenges to establishing local manufacturing to support the clean energy supply chain. These challenges include the relatively high cost of manufacturing, in large part due to higher labour cost than other South Asian counties, and current skills shortages. While high labour costs are a challenge, with the right communications strategy, these can be presented as the price premium associated with a local supply chain that offers stronger visibility and confidence across a range of environmental, social, and governance ESG measures.

We also have lower domestic demand due to a small population, which means that for some components, local manufacturers must look to export markets to achieve economies of scale. These reasons, coupled with a lack of stable industry policy, explain why Australia's historic capabilities in manufacturing have been lost over recent decades.

There has also been a lack of stable energy policy over the last ten years at the federal level and a lack of collaboration between states on energy policy. This has resulted in a patchwork of sub-national policies relying heavily on demand-based mechanisms rather than supply mechanisms, without an overarching strategy at the national level. In contrast to this, the US and Europe have offered generous and strategic incentives for manufacturers of the clean energy supply chain (using carrots rather than sticks), which has provided strong competition to relevant investment.

Recommendations for a more resilient clean energy supply chain in Australia

The Federal Government should take the lead in strengthening domestic supply chains, developing a National **Clean Energy Supply Chain Strategy** in the context of Australia's energy security. The success of any such strategy relies on credible, stable, ambitious, and long-term energy policies which provide an attractive investment environment. The National Clean Energy Supply Chain Strategy should include the following elements:

- **A whole-of-value-chain approach:** In determining which areas of the supply chain to focus on, the strategy should take a whole-of-supply-chain approach and begin by mapping the clean energy supply chain across technologies and the full value chain in consultation with industry.

  The strategy should take into account Australia's comparative advantage as a globally significant renewable energy producer, the large volumes of equipment that will be required across the clean energy supply chain, the need for security of supply to meet our decarbonisation and economic growth/diversification objectives, and the regional development benefits of domestic processing and manufacturing.

- **Recognition of competitive advantages:** Australia has an abundance of minerals critical to energy. We also have world-leading expertise in certain segments of the supply chain. The strategy should consider existing capabilities and capacity and establish clear and realistic targets to grow these capabilities while allowing for regional priorities and focus areas. Where local supply chains are judged to be uneconomic over the long term, alternative supply sources should be identified.

- **Substantial targeted government incentives for new local supply chain and manufacturing capability:** There will be no Australian clean energy supply chain without significant financial incentives. The CEC recommends that the proposed Clean Energy Transformation Investment Package provides a large allocation to support capex subsidies for new or expanded clean energy-related manufacturing facilities in Australia. Facilities which utilise innovative technologies could attract higher levels of financial support.

- **Readily achievable targets, paired with capability and capacity building:** State-based schemes have opted for local content targets to drive regional economic development. These can be helpful in sending a clear demand signal. However, it is imperative that any targets be informed by research into existing local technology-specific capability and capacity (including the ability to scale-up), and supported by capability-enhancement strategies and incentives where required.

- **Support for standards and testing capabilities:** Clean energy developers rely on certified supply chain elements that can demonstrate a track-record over time and in various environmental conditions. The risk of failure is too high in terms of safety, costs, and the ongoing social licence of the sector.

  There are barriers to Australian products becoming certified for use in the clean energy sector. These barriers are a lack of Australian testing facilities (the few that do exist are closing, which means that product validation needs to occur offshore, increasing costs and delays); the high costs of testing (governments can assist by subsidising this costs, especially for components with smaller volumes that struggle to distribute the cost); and a lack of harmonising across standards (in most cases it is most commercially beneficial to adopt the international standard, which would also address the inconsistency across Australian jurisdictions).

  The CEC recommends the harmonisation of Australian standards with international standards. We also recommend that targeted financial support is provided to establish new/expanded testing capabilities in Australia.

- **Identification of priority green industrial clusters/zones:** Industry clusters build critical mass essential to global competitiveness and promote strong partnerships with universities and different levels of government. The Federal Government, in partnership with the states and territories, should identify priority clusters in various jurisdictions and regions across Australia which can leverage our strengths and opportunities, and minimise duplication and unnecessary competition (which can dilute the advantages of scale) between states. CEC members rank 'industry clusters' as third in priorities that should shape Australia's clean energy manufacturing strategy, after jobs/ regional economic development and minimising costs.

- **Consideration of critical infrastructure needs:** Local capabilities are needed for critical infrastructure security; this should be a primary focus. For example, establishing local SCADA and controls capability would benefit security of critical infrastructure needs.

- **A workforce plan:** The clean energy transition already faces a shortage of skilled workers. This will be exacerbated by an increase in local manufacturing. A National Clean Energy Supply Chain Strategy should include mechanisms to support education and training, skilled migration, and maximising participation of underrepresented cohorts such as First Nations Peoples and women.

- **Futureproofing to automation and robotics:** As China manages the impacts of the one-child policy it is looking to maintain its status as a global manufacturer by fast-tracking automation and the development of robotics across the manufacturing floor. Australia may have an opportunity to adopt first- and second-generation technology of this type, which could potentially address some of Australia's challenges to manufacturing, such as skills shortages and high labour costs.

- **End-of-life and circular economy:** As solar panels, batteries and turbines come to the end of their useful lives, there needs to be a plan for decommissioning that is environmentally sound and cost effective. Without this, the industry will face renewed challenges from communities. Since 2020, the Clean Energy Council has collaborated with the industry, universities, regulators, government, and waste bodies to advocate for the establishment of an effective solar PV recycling stewardship scheme. The recycling of solar PV modules represents a significant market failure, and it will require governments to intervene to ensure the industry is supported and monitored in rolling out a successful recycling scheme. The demand for recycling facilities is there, but the cost of getting machinery to Australia or the technology required to build said infrastructure requires funding and support from Government.

  Industry support exists for the impost of an end-of-life collection and recycling levy that would apply to manufacturers or suppliers of solar PV modules. Our members support a scheme that sets a specific price per weight or product, as opposed to a price based on travel required to collect and recycle a panel.

Recommendation 3.41: The Federal Government should:

- Take the lead on strengthening domestic supply chains, developing a **National Clean Energy Supply Chain Strategy.** The success of any such strategy relies on credible, stable, ambitious, and long-term energy policies which provide an attractive investment environment. This strategy should include:
    - A whole-of-value-chain approach
    - Recognition of our competitive advantages
    - Substantial targeted government incentives for new local supply chain and manufacturing capability – facilities which utilise innovative technologies could attract higher levels of financial support.
    - Readily achievable targets, paired with capability and capacity building
    - Identification of priority green industrial clusters/zones
    - Consideration of critical infrastructure needs
    - Support for standards and domestic testing capabilities
    - A workforce plan
    - Future-proofing to automation and robotics
    - Support for the recycling of clean energy equipment at the end-of-life.
- **Recommendation 3.42:** Establish an effective solar PV recycling stewardship scheme. The CEC supports the impost of an end-of-life collection and recycling levy that would apply to manufacturers or suppliers of solar PV modules, which would set a specific price per weight or product.

SECTION 4: ELECTRIFICATION OF BUILDINGS AND TRANSPORT

Electrification of homes, business, industry and transport, underpinned by renewable energy and storage, is a key decarbonisation strategy for the Australian economy, and should be expedited wherever possible, noting the energy productivity benefits it offers consumers.

As neatly summarised by Energy Consumers Australia in its recent report, *'Stepping up: a smoother pathway to decarbonising homes,'*[17] the approximately 5 million homes connected to the gas network of the existing 11 million households in Australia will need to switch their home heating and cooking from gas to electricity within ~25 years. At the same time, 15 million passenger vehicles will need to be 'swapped' for electric vehicles with the necessary infrastructure in place to support them.

This change will involve higher upfront costs, but will deliver substantial cost savings over the long term, as is shown in the chart below. The average fossil-fuelled household would spend $2250 more in 2030 per annum than an efficient all-electric home. The savings would be substantially greater (a further $1250) for a home with rooftop solar and a battery.

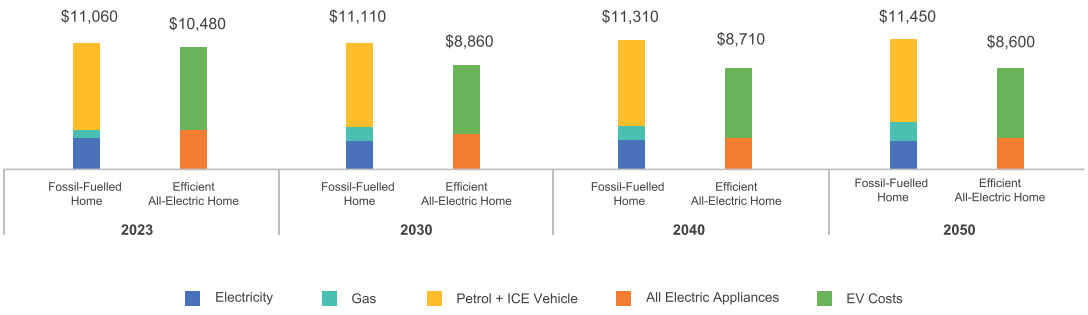


Figure 5: Total household energy spending in select years – an average fossil fuelled home compared with an efficient all-electric home (Energy Consumers Australia, 2023)

Note: projected savings are higher for households with rooftop solar and a battery.

Fuel switching from gas and oil to direct electricity is more energy efficient and will ultimately result in lower consumer costs and greater energy productivity across the economy. And with high and volatile gas and oil prices currently being experienced – and the expectation that Australia's east coast gas prices will remain elevated over the long term[18] – there is no reason for delay.

The first action by governments must be to communicate end dates for the sale of combustion-based household vehicles and appliances. These timeframes should be set as soon as possible in alignment with achieving Australia's goal of net zero emissions by 2050, while allowing ample time for markets and consumers to plan and adjust.

Similarly, new gas connections for new homes and light commercial businesses (e.g. retail, offices) should be immediately banned across Australia, given that there is no prospect that hydrogen or biomethane will be an efficient or scalable solution for distributed gas networks. It therefore makes no sense to continue to expand a network that cannot deliver net zero emissions. These gases may however make an important contribution in the industrial sector as chemical feedstocks or for hard-to-electrify energy needs such as very high-temperature process heating.

Next, governments should provide incentives for early movers, and assist low-income households to be among them, ensuring that wherever appliances are replaced, consumers are strongly incentivised to select a more efficient electric appliance or vehicle. All electric appliances (e.g. heat pumps, electric vehicles) are typically more expensive than their fossil fuel equivalents, and as such, governments

[17] Stepping-Up-Report-Final.pdf (energyconsumersaustralia.com.au)

[18] https://www.rba.gov.au/publications/bulletin/2021/mar/understanding-the-east-coast-gas-market.html#fn1

should seek to close the cost gap. This could be delivered through a variety of methods from rebates to tax write offs, though we note that the objective should be to make the process as simple as possible. These incentives can complement access to low-cost finance via the Clean Energy Finance Corporation, which the Government announced in its Budget earlier this year.

As a further measure to support lower-income households, and as recommended by the Grattan Institute in its recent Getting off Gas' report, Government should also consider introducing a tax-write-off for landlords who opt to replace broken gas-based appliances with efficient electric ones.

Finally, governments should ultimately use regulation to enforce broad-based change, by outlawing the sale of less efficient appliances and vehicles through tightening efficiency standards, including the promised fuel-efficiency standard for vehicles.

Throughout this change, strong communication and public information campaigns will be required, to ensure that all consumers are aware of the direction of travel, and Australians do no wind up investing in new equipment which will not only cost them more to run, but may also have a limited lifespan.

Increased investment will also be required in workforce attraction and development for electricians, plumbers and other related occupations to ensure that we can mobilise the skilled workers we need to support Australians in this major transition.

Recommendation 4.1: Communicate end dates for the sale of combustion-based vehicles and household appliances. These timeframes should be set as soon as possible in alignment with achieving Australia's goal of net zero emissions by 2050.

Recommendation 4.2: *New gas* connections for homes and light commercial businesses (e.g. retail, offices) on the distribution network should be immediately banned by governments across Australia.

Recommendation 4.3: Provide incentives for early movers, ensuring that wherever appliances are replaced, consumers are strongly incentivised to select a more efficient electric appliance or vehicle. Priority should be given to supporting low-income households to be among the early movers.

Recommendation 4.4: Government should consider introducing a tax-write off for landlords who opt to replace broken gas-based appliances with efficient electric ones.

Recommendation 4.5: Employ regulation to enforce change by outlawing the sale of less efficient appliances and vehicles through tightening efficiency standards, including the promised fuel-efficiency standard for vehicles.

Recommendation 4.6: Work with states and territories to invest strongly in clear and sustained public information campaigns to support consumer awareness of the electrification transition.

Recommendation 4.7: Work with states and territories to invest in workforce attraction and development for electricians, plumbers and other related occupations who will be vital to competently and safely manage the electrification transition.

SECTION 5: GREEN VALUE-ADDED PRODUCTION AND EXPORTS

Accelerating international momentum to meet decarbonisation goals and decouple from volatile fossil fuel prices is beginning to drive demand for green commodities such as metals (iron, aluminium) and fuels (ammonia, methanol). This presents a major opportunity for Australia which we are well-positioned to capture. It is imperative that we seize it.

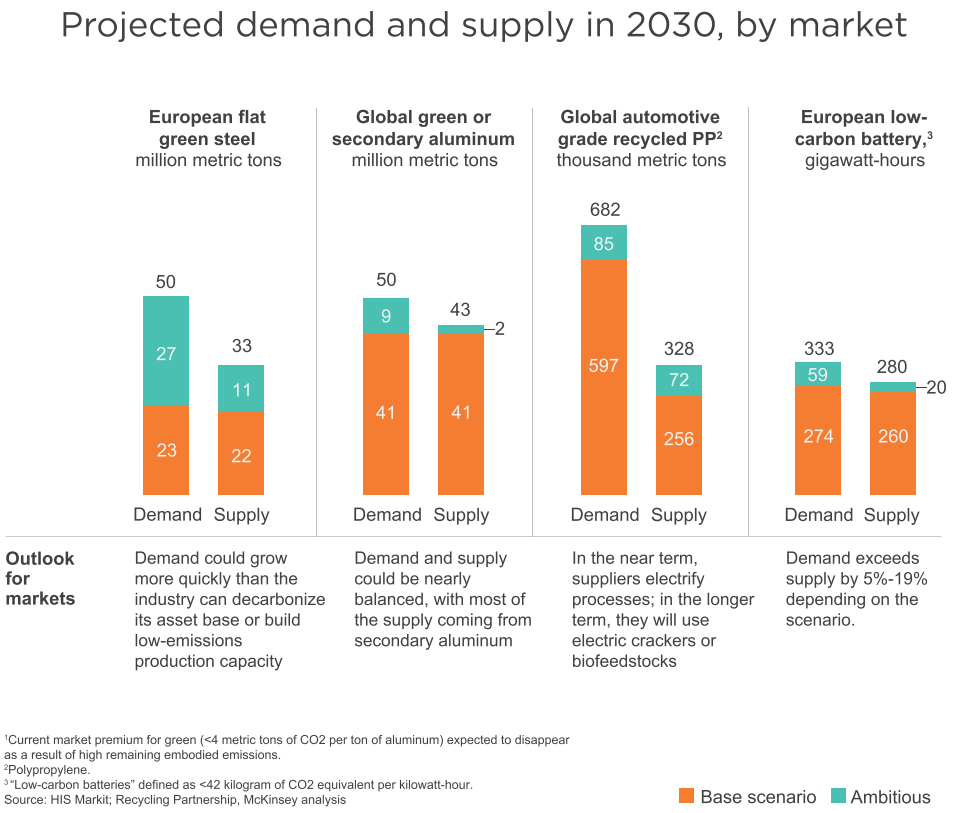


Figure 6: Demand for certain green materials could exceed supply in large markets (McKinsey & Co, 2022) [20]

Our three largest exports today are iron ore, coal and liquified natural gas. Two of them – coal and LNG – collectively worth $185 billion in exports to Australia in 2022, should now be treated as sunset industries. They will have little or no role in the net zero world of 2050. Australia must plan in earnest now for the new commodities and markets that can replace these valuable sources of revenue and employment.

Two major categories for value-added green energy markets are emerging as frontrunners for domestic production, based on their ability to leverage our comparative advantages in renewable energy and mineral resources:

1. green hydrogen derivatives – ammonia and methanol, and possibly others for use as energy vectors or chemical feedstocks
2. Minerals processing – led by metals including green iron, and 'energy transition minerals' including lithium

We discuss these opportunities and priorities below.

[20] The new imperative for green commodities | McKinsey

5.1 GREEN HYDROGEN AND ITS DERIVATIVES

Hydrogen and its derivatives (such as ammonia and methanol) were clearly identified by Australian governments as one of Australia's major export opportunities in the National Hydrogen Strategy, published in 2019.

The strategy expressed an aspiration for Australia to be a top-three supplier of hydrogen to Asian markets, and provided a broad framework for removing regulatory barriers to industry development and building general capabilities and preparedness for future market opportunities. It stopped short of setting hard and fast production, consumption or export targets, and did not establish any policy mechanisms to incentivise production. Rather, it was left to the individual states and territories to determine their own industry development strategies.

Since the strategy was released, Australia has built a formidable pipeline of early-stage projects. As at late 2022, it was the largest of any aspiring production markets to date, as shown in the chart by Rystad Energy below[21].

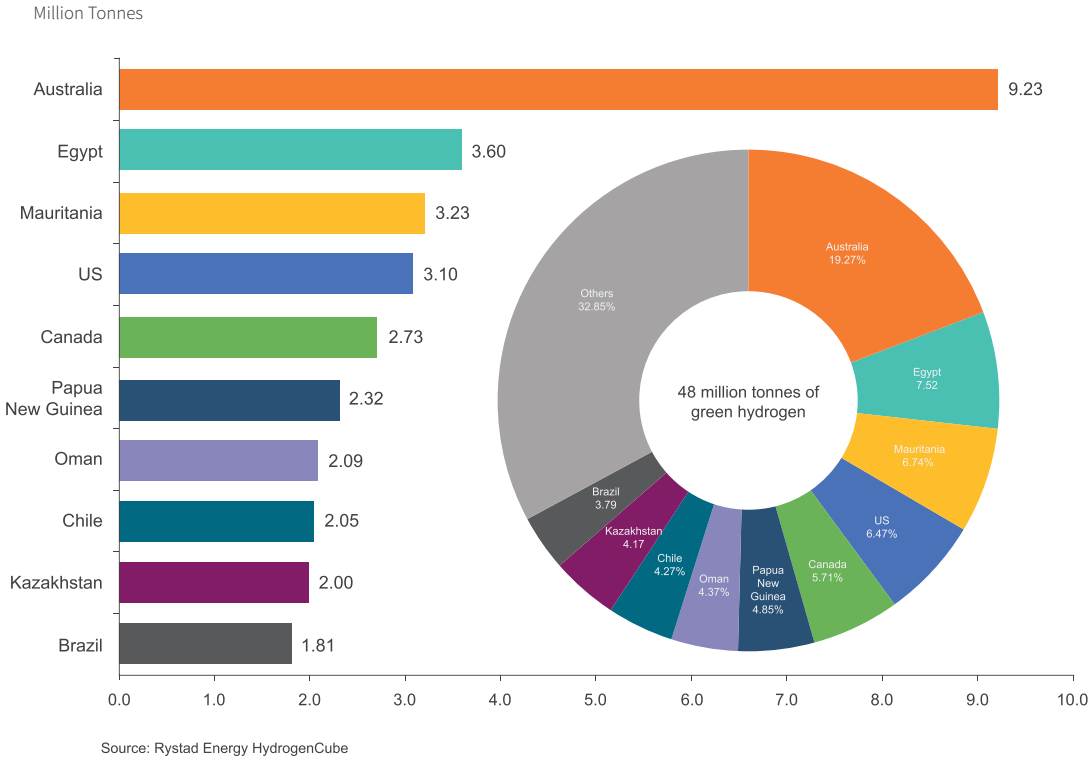


Figure 7: Top 10 countries based on green hydrogen production announcements, as at October 2022

However, Australia is struggling to convert, with just two large-scale hydrogen projects, each of 10 MW currently under construction. Both of these have been made possible with the support of ARENA's Renewable Hydrogen Deployment Funding Round[22]. This is despite a potential project pipeline of around 10 million tonnes per annum today.

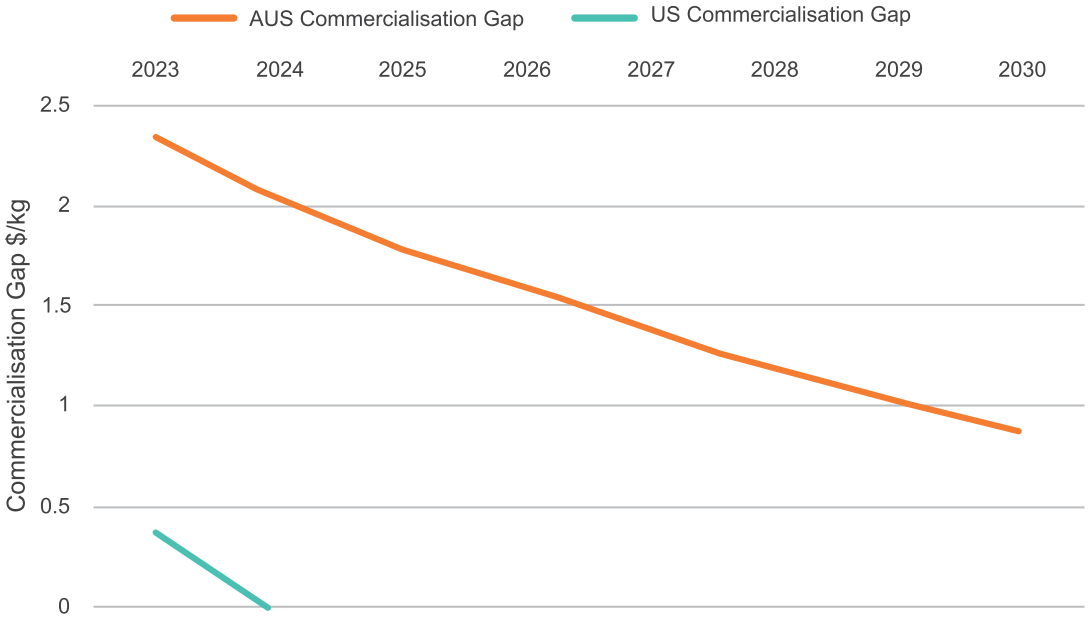
[21] Egypt soars up hydrogen production table as pledged investments top $100 billion, Rystad Energy, October 2022

[22] Green light for pioneering regional hydrogen project - Australian Renewable Energy Agency (arena.gov.au)

There are a range of reasons why development has so far been slower than hoped:

1. **High complexity of projects:** Hydrogen projects are technically complex with a large number of infrastructure and commercial elements which need to come together for a successful project:
    - Identifying a viable use case for the hydrogen
    - Securing an offtaker at a price premium to fossil-based alternatives
    - Access to low-cost renewables
    - A sustainable water source of appropriate quality
    - A hydrogen storage solution
    - Transportation of the product to the offtaker
2. **A limited number of viable, domestic offtake opportunities in Australia:** Current hydrogen production and use in Australia is limited (largely to ammonia production). This dearth of opportunities means that many proponents will need to seek offtake opportunities from international markets, which again increases the complexity of the venture.
3. **Price premiums and buyer hesitancy:** Ammonia – commonly used in fertiliser manufacturing – is a low-margin commodity, and proponents report a high degree of price sensitivity among buyers, who are often choosing to wait for anticipated cost reductions over time. Without funding support or subsidies like those that have been committed in other markets, Australian projects will struggle to strike offtake agreements in the near term, and this could result in Australia being locked out of long-term opportunities.

Before the IRA was passed, Australia enjoyed a reputational advantage over many other aspiring low-cost hydrogen production regions of being a more secure place to invest, as a free-market liberal democracy with its strong institutions and rule of law. Now, however, with the US on the field and Canada's matching incentives, competition has stiffened. Deloitte now estimates that the US has now effectively closed the commercialisation gap for new green hydrogen projects, and incredibly, within a few years, US these projects could be making a profit even without the benefit of an offtake agreement being in place.



Notes: Deloitte analysis. The commercialisation gap is estimated as the price differential between renewable hydrogen LCOH and grey hydrogen assuming application of a carbon price aligned to the Safeguard Mechanism cap.

Figure 8: Delays in closing the commercialisation gap risk shutting Australia out of early offtake contracts[23] (Deloitte, February 2023)

[23] Australia's Hydrogen Tipping Point | Deloitte Australia

What Australia should do

The resource requirements of establishing a world-beating green hydrogen industry are very large, and if Australia truly wishes to become a leader, it must dramatically boost its level of planning and investment in the sector.

1. **Strategic planning:** The resource and infrastructure requirements of a green hydrogen sector are large, and detailed strategic planning is required in relation to electricity generation and water requirements; land use; environmental and social impacts; enabling infrastructure including transmission, pipelines, and ports; community and social licence, workforce readiness and public safety. We recommend that this detailed planning be expedited by Federal, State and Territory governments in a co-ordinated manner for identified green industrial zones/clusters. This should particularly consider the opportunities to couple green hydrogen development with green iron, ammonia/fertiliser and methanol production, as leading applications of hydrogen use.

2. **Long-term policy mechanism to support large-scale green hydrogen:** Australia also needs an enduring policy mechanism to support green hydrogen production. The Australian Government has announced a $2 billion fund for the Hydrogen Headstart program, which will provide a production credit per kilogram of hydrogen. It is expected that this program will support at least two large-scale projects of at least 50 MW in capacity.

   The Government has recognised that Headstart is a downpayment on the development of Australia's hydrogen industry, and it is currently considering its longer-term support. Noting that Headstart will only be able to support a limited number of projects from a large field of potential candidates, and that the uncertainty around longer term policy arrangements will have a chilling effect on projects, we urge the Government to outline its larger, long-term project support arrangements for early mover projects as soon as possible. This support should have the objective of accelerating the scale-up of Australian industry to an internationally cost-competitive basis.

   We note that Deloitte's analysis[24] of a range of policy support options found that hydrogen production credits were deemed to be more efficient than capital grants and investment tax credits. This analysis also found that a hydrogen production credit of AUD $2/kg 'around half the level of the maximum credit in the IRA for renewable hydrogen' – would be required, 'underlining Australia's underlying comparative advantage'. This would require Government investment in the order of $15.5 billion in today's terms over a decade. We note that this quantum is broadly commensurate with Canada's investment commitment in response to the IRA (~$20.6 billion). According to Deloitte, a $15.5 billion investment would put Australia on track to produce almost 16 million tonnes of renewable hydrogen a year by 2050, with exports worth $17.4 billion per year in today's terms.

3. **Government procurement commitments to green content in infrastructure projects:** The government sector in Australia – and in particular, State Governments – are major purchasers of commodity products such as steel and aluminium for major infrastructure projects such as roads, bridges, railway lines, buildings and other public infrastructure enhancements and expansions. The public sector can utilise its significant purchasing power to provide demand for green/greener commodities.

   Federal, State and Territory governments could, for example, set firm long-term targets (e.g. for 2030 and beyond) for local, green content within their infrastructure projects, which could provide much-needed demand for the establishment of zero or low carbon manufacturing facilities.

[24] Australia's Hydrogen Tipping Point | Deloitte Australia

4. **A guarantee of origin scheme:** A robust guarantee of origin scheme to verify the environmental claims of Australian hydrogen producers will be a necessary complement to our export aspirations.

   The CEC supports the general approach currently being pursued by the DCCEEW and the CER, and provides in principle support for the introduction of a Renewable Electricity Guarantee of Origin (REGO) scheme in a timely manner. A REGO scheme will allow the appropriate attribution of renewable electricity purchases and can work in tandem with other renewable energy policies and support mechanisms.

   Some CEC members have concerns about the interaction of the Guarantee of Origin framework and incentives for renewable energy development. Accordingly, the CEC believes the implementation of Australia's Guarantee of Origin frameworks should occur alongside recommendation ***2.11; Extend the Large-scale Renewable Energy Target (the LRET) beyond 2030 to at least 2040, and increase the level of ambition to support the Government's commitment to 82 per cent renewables by 2030.***

   The broader Guarantee of Origin (GO) scheme would require reporting across a range of core product characteristics (e.g. production method; emissions intensity per unit of production), while allowing flexibility for projects to report on other criteria (e.g. additionality of generation; time-matching) as may be required by their customer markets.

   The CEC contends that the setting and adoption of standards should be kept separate from the GO scheme itself, but that the GO scheme should be equipped to allow proponents to report against the standards relevant to their product. Refer to the **CEC's submission in February 2023** for more information about this matter.

Recommendation 5.11: Expedite detailed strategic land use and infrastructure planning for identified hydrogen hubs/green industrial zones. This planning should consider the integrated system needs of a hydrogen production industry, and sector coupling opportunities (e.g. green iron).

Recommendation 5.12: The Australian Government should outline its long-term support arrangements for large-scale hydrogen projects as soon as possible. We recommend that between $15–$20 billion should be allocated to revenue support for early mover projects over 10–15 years, as part of a broader $100 billion Clean Energy Transformation Investment Fund.

Recommendation 5.13: The Federal, state and territory governments should set firm long-term targets for local, green materials content within their infrastructure projects, which could provide much-needed demand for the establishment of zero or low carbon manufacturing facilities.

Recommendation 5.14: The proposed Guarantee of Origin framework should be implemented in a timely manner, and alongside implementation of recommendation 2.11 (RET increase and extension) to provide Australia with an essential mechanism to be able to demonstrate the renewable electricity and environmental credentials of the products we produce, for both domestic and international consumption.

5.2 MINERALS PROCESSING

The refining of minerals into metals ranks among the most energy-intensive industrial processes that exists, and as such, it represents an ideal market growth opportunity for a country rich in mineral resources which aspires to being a renewable energy superpower.

Surprisingly, Australia does very little minerals processing itself today. As Professor Mike Sandiford of the University of Melbourne notes in The Superpower Transformation, 'almost all processing of Australian ore is now undertaken offshore'[25]:

Prior to 2000, the value of mineral ores export credits sat at about 1.8 times the refined metal production. This ratio is now at around fifteen and reflects the progressive shift in capital allocation in the resource sector almost exclusively to mine development, at the expense of mineral processing.

In a net zero emissions world where Australia enjoys an advantage as a producer of clean, low-cost electricity, it will be logical for Australia to play an expanded role in mineral refinement processes. This includes for iron ore, bauxite (the mineral used for alumina/aluminium production), copper, lithium, nickel, cobalt, manganese, and a range of rare earth elements (e.g. vanadium, silicon).

Green iron

A particularly attractive processing opportunity for Australia is the reduction of iron ore to iron metal with the use of renewable electricity and green hydrogen as a reduction agent (in place of metallurgical coal). This would significantly reduce the future electricity demand of our existing iron ore customer markets (China, Japan, South Korea) – many of whom are resource or space constrained – while enabling them to largely retain their existing steel production industries and workforces. This decarbonisation strategy for the steel industry would be much more energy efficient than a model in which Australia would ship both iron ore and green hydrogen to steel producing countries, given the energy losses involved in hydrogen compression or conversion to more transportable energy carriers (e.g. ammonia).

To capture the full opportunity that green iron presents, strong investment will be needed to upgrade some of our most plentiful iron ore resources (haematite) into products with higher iron concentrations, suitable for green iron production. The Government should support research and development efforts in this important area, noting its strategic economic value to the nation.

Next, the Government should move to quickly declare green iron a priority development market, and allocate at least $10–$15 billion within the proposed Clean Energy Transformation Investment Fund to attracting early mover green iron plants in Australia over the coming decade. These plants are highly capital intensive and require long lead times for development. Any aspiration to build green iron processing capacity in Australia by 2030 would require immediate action.

Battery minerals processing

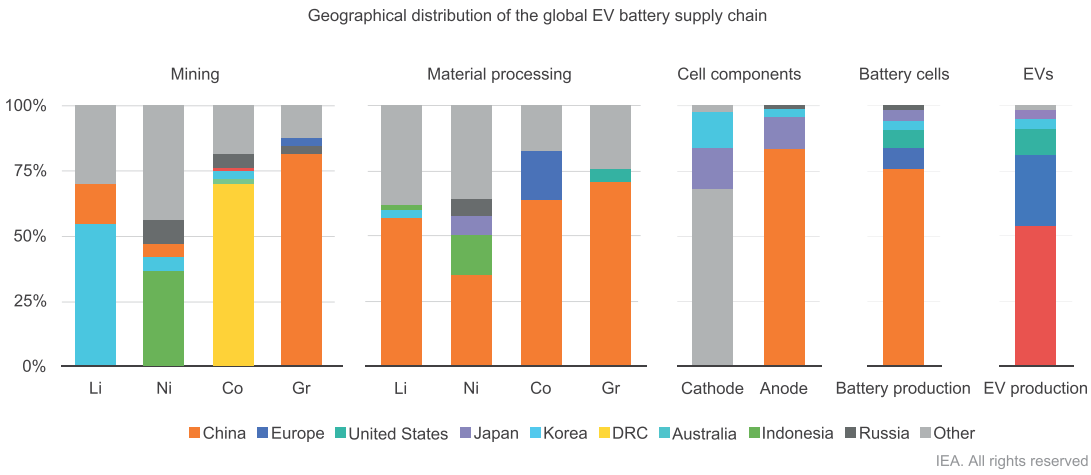
Another major economic expansion opportunity for Australia participation in battery supply chains. A recent study by the Future Battery Industries Co-operative Research Centre[26] (CRC) underscores the rapid growth of the global battery sector. Global battery demand is now forecast to grow at 34 per cent per annum to 2030, increasing 18-fold on 2020 levels, which is a 64 per cent increase in demand in 2030 relative to previous forecasts by the CRC.

[25] Sandiford, M., 'The Net Zero Opportunity for Australian Metals' chapter, within The Superpower Transformation, edited by Ross Garnaut, (2022)

[26] Charging ahead: Australia's battery powered future, Future Battery Industries CRC, March 2023

All of the input minerals and materials required for lithium ion batteries – the leading technology globally in battery storage solutions – are found in Australia, and Australia currently plays a significant role in the production of many of them. We are the world's largest supplier of lithium, accounting for over 50 per cent of global lithium mine production (80 per cent of the lithium feedstock used by Tesla in its batteries today is sourced from Australia). Australia is also the third largest producer of manganese, the fifth largest producer of nickel, and the third largest producer of cobalt (although with much smaller reserves than the dominant supplier, the Democratic Republic of the Congo).

However, as with the broader story of minerals processing in Australia, Australia refines very little of the minerals we mine for the battery supply chain, as shown in the chart from the International Energy Agency below.



Notes: Li = lithium; Ni = nickel; Co = cobalt; Gr = graphite

Figure 9: Dig and ship – Australia's currently plays almost no role in processing/assembly of the minerals we export, and China dominates the downstream EV battery supply chain[27]

Given Australia's dominance of lithium mining, there is an opportunity for it to play a particularly significant role in the processing of the lithium ore body, spodumene, into the products used in batteries – lithium hydroxide and lithium carbonate. Some progress has been made here in recent years, with three lithium refineries currently ramping up in Western Australia. However, with 96 per cent of the ore still being exported, much greater investment will be required in domestic refining capacity if we are to play a meaningful role in this value-added production opportunity. In a recent speech, the Chair of Tesla Motors, Robyn Denholm[29], stated that the number of plants in Australia today would need to increase by an order of magnitude, if we were to play a dominant role in lithium processing in Australia.

Unpublished analysis undertaken by consulting firm Mandala Partners, indicates that in an ambitious scenario in which Australia were to undertake onshore processing of 50 per cent of the lithium it mines, Australia could generate up to $18 billion in gross value added for Australia annually, and support 7000 jobs in lithium refinery plants by 2035. This is almost three times the gross value added and workforce size of the business as usual scenario.

This is just one example of the potential for growth in the battery supply chain, with Tesla citing other opportunities for Australia to also play a role in the production of 'concentrates, reagents, the battery grade fine particles and materials, the precursors, the cathodes and much more'[30].

[27] Global Supply Chains of EV Batteries, International Energy Agency, July 2022, page 5

[29] 'Speech by Chair of Tesla Motors, Robyn Denholm, to the Minerals Council of Australia, September 2022 (unpublished)'.

[30] Ibid

Investment in global battery supply chains has skyrocketed over the past year as the electrification push has gathered pace and the US has sought to secure a much larger role within in the critical minerals and battery assembly supply chains through the IRA. Over 70 per cent of the total investments announced since the passing of the IRA have been in battery production[30].

As a Free Trade Agreement partner of the US, Australia can and should leverage this historic moment to dramatically increase inbound investment in our domestic battery minerals refining capability. The CEC recommends that the Government outlines its vision for securing a larger role in value-added processing for battery supply chains, and provide substantial incentives in the form of production tax credits, capex subsidies and tax write-offs for the establishment of local refineries.

In designing the support arrangements, we encourage the Government to adopt the spirit of the IRA and make the criteria for accessing the incentives as simple and straight forward as possible, such that investors can make relatively swift and sure-footed judgements about how they can qualify to access funding. Complex rules and drawn-out assessment processes with discretionary criteria will simply lead to further uncertainty.

Recommendation 5.21: The Australian Government should:

- Re-build and expand Australia's mineral processing capabilities through investment attraction strategies.
- Outline the Government's vision and objectives for an expanded role in value-added processing in the battery supply chain.
- Provide a substantial funding allocation within the Clean Energy Transformation Investment Fund to attract investment in energy transition minerals processing plants in Australia. This support could be offered in a variety or combination of ways, including production tax credits, capex subsidies, and tax write-offs. The criteria for accessing this financial support should be as simple and straight forward as possible.
- Move to quickly declare green iron a priority development market, in light of the symbiotic relationship between green hydrogen and green iron, and the long lead times for new capital-intensive plant.
    - Support R&D efforts to enable a green iron industry to utilise our large hematite resources.
    - Allocate at least $10–$15 billion of the Clean Energy Transformation Investment Fund to attracting early mover green iron plants in Australia over the coming decade.
- As discussed in Section 5.1, set firm long-term targets for local, green materials content within infrastructure projects, which could provide much-needed demand for the establishment of zero or low carbon green iron manufacturing facilities.

[30] **Inflation Reduction Act (IRA) and CHIPS and Science Act Investments | Jack Conness**

APPENDIX 1: OUTLINE OF A RENEWABLE ENERGY SUPERPOWER MASTERPLAN FOR AUSTRALIA

The Clean Energy Council is calling for a 'Renewable Energy Superpower Masterplan' to be developed for Australia. The purpose of the masterplan would be to articulate the vision for the role Australia intends to play as a producer and exporter of clean energy and green value-added commodities, and to guide the allocation of public and private investment and resources.

The below Table of Contents outlines our view of the scope of this masterplan.

Indicative Table of Contents

1. Global demand for net zero products
2. Australia's **natural** advantages to meet global demand
   - 2.1. Land and waters, renewable energy resources, mineral resources
3. Australia's **strategic** advantages
   - 3.1. Proximity to Asia, established trade links, skilled energy and resources workforce
4. Assessment of global market opportunities for clean energy and green commodities
5. Criteria for assessing priority markets for Australia
   - 5.1. Compatibility with available natural resources
   - 5.2. Compatibility with strategic advantages
   - 5.3. Economic and regional development benefits
6. Identification of priority markets for Australia
7. Physical and social requirements and constraints for priority markets
   - 7.1. Land use – scale and location
   - 7.2. First Nations and community engagement
   - 7.3. Resources – energy, water, minerals
   - 7.4. Infrastructure investment – electricity generation, transmission, water processing and transport infrastructure, ports, roads, rail.
   - 7.5. Local social infrastructure - hospitals, housing, schools etc
   - 7.6. Supply chain – technology requirements, availability of equipment and risks to supply; opportunities for, and appropriate contribution of domestic manufacturing to meet equipment needs; circular economy needs to maximise efficiency of resource use and minimize waste.
   - 7.7. Workforce – workforce size and composition, localised needs, mobility and skilled migration; identification of skill gaps; assessment of the preparedness of education and training systems, and required capacity building.
8. Policy requirements for priority markets and green industrial zones/clusters
   - 8.1. Australia's current competitiveness within identified markets
   - 8.2. Assessment of existing policy settings
   - 8.3. Policy settings to attract private investment
   - 8.4. Regulatory/policy harmonisation opportunities across state/territory jurisdictions
9. Governance structures to deliver the vision for key markets
10. Monitoring and reporting of progress

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