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Sunshot: Achieving global leadership in clean exports

A policy roadmap for Australia

Final report

September 2023

Acknowledgement of country

Accenture respectfully acknowledges Australia's Aboriginal and Torres Strait Islander people as the Traditional Owners of Australia and pay respect to their Elders past, present, and emerging.

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Executive summary

In 2021, the Sunshot Alliance, representing Australian business, workers, and our environment, came together to release *'Sunshot: Australia's opportunity to create 395,000 clean export jobs'*. The report identified the risks to Australia's economy if we continue our reliance on fossil fuel exports and laid out an alternative vision for our future: an export economy driven by the clean energy and materials required for the globe's energy transition. This vision had the potential to transform our economy, adding over $100b in value and over 400,000 jobs[1], whilst underpinning future prosperity as the world increasingly moves away from fossil-fuel related goods.

Since 2021, the global pace of the energy transition has rapidly increased, driving growth in 5 priority clean exports in Australia to $314b p.a. in revenue by 2040. The clean exports identified in the original Sunshot report already had the potential to create more value and add more jobs to the Australian economy than the fossil fuel industry. In a high ambition scenario, assuming policy support, the combined opportunity from 5 prioritised exports[2] has now more than doubled. By 2040, Australia could achieve:

- **$121b critical minerals revenue**, from retaining world leading positions in mining and increasing value-adding onshore; to 60% of critical minerals[3].
- **$96b green iron & steel revenue**, from becoming a leading producer of green iron in a global market that rapidly decarbonises, producing 268mt p.a. of green iron to support this decarbonisation and increasing our own green steel industry to 20mt p.a.
- **$39b battery supply-chain revenue**, from policy to develop over 100GWh of battery pack manufacturing capacity p.a, supported by cell manufacturing and active materials capabilities.
- **$32b green hydrogen & ammonia revenue**, from a 15mt p.a industry supporting our green steel opportunity and exporting to key trade partners with hydrogen targets.
- **$26b green alumina & aluminum revenue**, from extending Australia's current capacity to 5mt p.a by increasing access to firmed renewable energy.

Capturing this opportunity would see Australia become a global leader in clean exports. The opportunity is by no means assured, it will require focused public and private effort to transform our economy across three key imperatives; value-add more of our raw materials onshore, accelerate the development of our manufacturing capabilities and produce materials with lower embodied carbon at relatively lower costs as inputs to the globe's energy transition.

The opportunity has increased to $314b by 2040 in a high ambition scenario

Notes: 1. job estimates were revised from the original report. 2. This does not necessarily reflect the breadth of clean energy industries Australia could pursue, opportunities have been prioritised based on Australia's potential to be a global leader in exports of the good, not domestic consideration. 4. Includes lithium, cobalt, copper, rare earth elements,, nickel and manganese

Executive summary

The window to capture this opportunity is closing fast as other countries invest heavily in their own sovereign capabilities. The U.S has committed over $1.2t[1] over 10 years through the IRA, Canada has invested $94b over 10 years and other countries and regions are mobilising investments from a mixture of funding sources[2].

International investments have been a response, in part, to China's dominance in clean energy. Over successive policies, China has made direct investment into clean energy, this has led to dominant positions in the manufacturing of many clean technologies[4]. The rest of the world is responding by building their own capabilities to capture the economic opportunity, guard against geopolitical risk, and to support their own decarbonisation by lowering costs for the required clean materials & avoiding supply constraints.

International investment is creating the policy settings and signals to unleash historically high levels of private investment – Australia is at risk of losing out on the global race for this capital. Over $400b of private investments have been announced in the U.S alone since passage of the IRA[3], and China's catalysed private investment was world-leading at $815b[3] in 2022. Private investment is essential to building the capabilities required for the $314b export revenue in a manner that is fiscally sustainable long-term.

Whilst these investments pose a risk that Australia could miss out on the race for capital and capabilities, they also provide an opportunity through new selective markets. Whilst countries are seeking to develop some sovereign capability, no one will be able to succeed in the energy transition alone. Many partner countries who are investing in clean energy are increasingly looking to 'friend-shore'. This includes giving select partners access to parts of their investment and increasing levels of trade with a select few for their clean energy goods. Australia has access to parts of the U.S IRA and can step up to fill the supply-gap from partners who are limiting imports from China.

Considering the international landscape, Australia needs its own globally ambitious, proportionate and targeted clean energy policy that will encourage and leverage private investment across 4 pillars. These pillars include; renewable energy buildout that's good for workers, nature & communities, clean industry & exports policy, widespread electrification and climate & transition readiness.

The realisation of the $314b export opportunity will require policy support across all 4 pillars. This report focuses on the support required within the clean industry & exports policy pillar for the 5 prioritised industries only.

Considering the international landscape, Australia needs a comprehensive clean energy policy across 4 pillars; this report focuses on 5 priority industries within the clean industry and exports pillar only

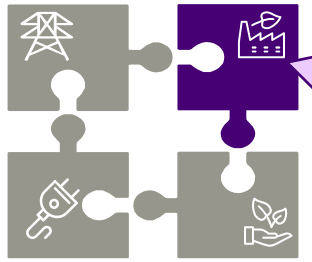
The 4 clean energy policy pillars

1. Renewable buildout that's good for workers, nature & communities

Facilitating renewables at the speed and scale required for clean industry and domestic use whilst delivering benefits for workers, communities, First Nations & nature.

2. Clean industry and exports policy

Direct investments and policy support to build capabilities in clean energy industries.



Scope of this report: clean industry policy for 5 prioritised exports only – further assessment is required across other industries and pillars.

3. Widespread electrification

Investments in electrification and energy efficiency to support decarbonisation targets and drive demand for clean industry.

4. Climate and transition readiness

Investments to avoid & prepare for adverse climate events and policy to support a just transition with a focus on community and First Nations benefit.

Scaled to Australian GDP, the U.S and Canada have invested $74-80b across comprehensive clean energy policies which consider all 4 policy pillars[5].

Notes: 1. All figures are AUD (1:0.67 USD), 2. For example Korea has mobilized over $60b in funds, the EU has mobilized over $600b, 3. $270b USD, considers clean energy related investments only. The Whitehouse reports over $500b USD ($746AUD) in manufacturing investments post IRA, IIJA and CHIPS act. Consideration of these acts would see an even higher U.S investment however the include investments that are not clean energy related.3. $546b USD, 4. for example China holds a >50% market share across the battery value chain from refining of raw materials to cell manufacturing. 5. Considers investment as a proportion of a countries GDP and applies this to Australia's GDP, converted to AUD

Executive summary

A $38b public investment over 10 years, specifically focused on the clean industry policy pillar, can catalyse further private investment to support Australia in reaching globally leading positions in the 5 prioritised industries. This would need to be delivered in tandem with policy support for sufficient renewable capacity buildout, electrification and climate readiness.

The $38b investment would be delivered through mechanisms which:

- **Address the short-term challenges to investment** such as a lack of domestic offtake and trade & regulatory barriers.
- **Build long term capability** to overcome workforce shortages, lack of domestic feedstock and technical & scaling challenges.
- **Raise our ambition to win** to support Australian competitiveness internationally and retaining private investment onshore, considering support on offer globally.

These mechanisms will build an environment that can galvanise private capital. Public investment could crowd in 2.8x or more[1] private capital through increasing the ease of business investment and project timelines in Australia, sustainably reducing the cost of production overtime and ensuring that capital can achieve an internationally competitive return.

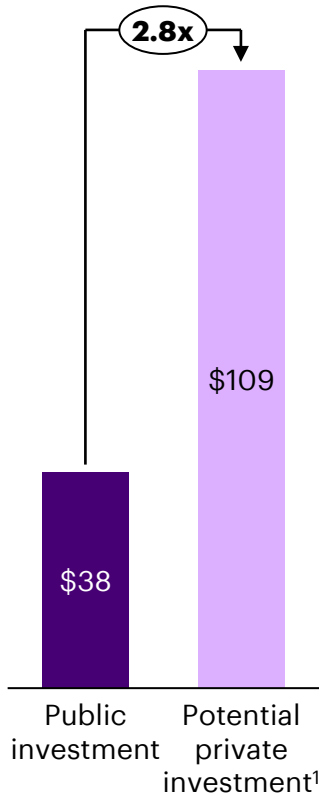
Delivery of this investment can be combined with supporting wider social outcomes. This includes embedding requirements for fair labour standards, assisting with transitioning industry to renewable energy & jobs in regions dominated by coal & gas and supporting community, First Nations and nature benefits.

This investment is globally ambitious for the scope considered and would position Australia as a leader in clean industries, helping to secure our economic prosperity in a low-emissions world. For comparison, investment related to the clean industry & exports policy pillar from the U.S and Canada is $27-31b[1] (scaled to Australian GDP). The ambitious $38b public investment, with sufficient consideration of other pillars, can catalyse further private investment and pave the way for Australia to meet the targeted $314b in revenue across the 5 prioritised industries. This will require a transformation of the economy to be more focused on value-add, manufacturing and embedded decarbonisation, and allow us to play a leadership role in the global effort to achieve net-zero emissions and address the climate crisis.

A $38b clean export industry pillar investment to 2034, delivered through the right mechanisms, can catalyse private investment and support Australia to reach globally leading positions across 5 prioritised industries

Billions AUD, 2024-34

Critical minerals · Green metals[2] · Batteries · Green H_2 & ammonia



Delivery mechanisms

Address short-term challenges

- Robust, fair, timely & community driven assessments & approvals[3]
- International cooperation
- Government procurement

Build long-term capability

- Skill programs – NZA[4]
- Priority status in assessments & approvals for onshore value-add[3]
- Strengthening and co-investing in the R&D ecosystem
- Funding industrial precincts – NZA[4]

Raise ambition & win

- Production incentives (CFD or tax credit)
- Hydrogen inputs incentives (CFD or tax credit)

For comparison, the U.S & Canada have invested $27-31b publicly across the clean industry & exports pillar[5].

Notes: All figures are AUD (1:0.67 USD), 1. See private investment catalysed methodology in appendix, recent CEFC experience shows this could be as high as 5x. 2. .Green Iron and Steel policies assessed separately to green alumina and aluminum, 3. All policy analysis regarding assessments and approvals ensure that all current environment and regulatory requirements will only be enhanced. 4. Net Zero Authority, 5. U.S and Canada selected for direct comparisons throughout this report as their investment is being delivered through their respective Government's treasuries. Policy packages considered are the U.S Inflation Reduction Act and Canada's 2023 budget - considers investment as a proportion of a countries GDP and applies this to Australia's GDP, converted to AUD.

The pace of the global energy transition is increasing, driving greater demand for clean energy technologies and their materials

Countries are increasing their ambitions to decarbonise; the globe's largest economies have net zero targets, many including interim 2030 targets. This has driven a significantly higher demand for clean energy technologies and their critical minerals.

For example, over the last 5 years, EV and battery demand has grown over 10x, driving an increase in lithium and cobalt demand of 194% and 76%. The rapid increase in demand has often outpaced supply, leading to record high lithium prices in 2022.

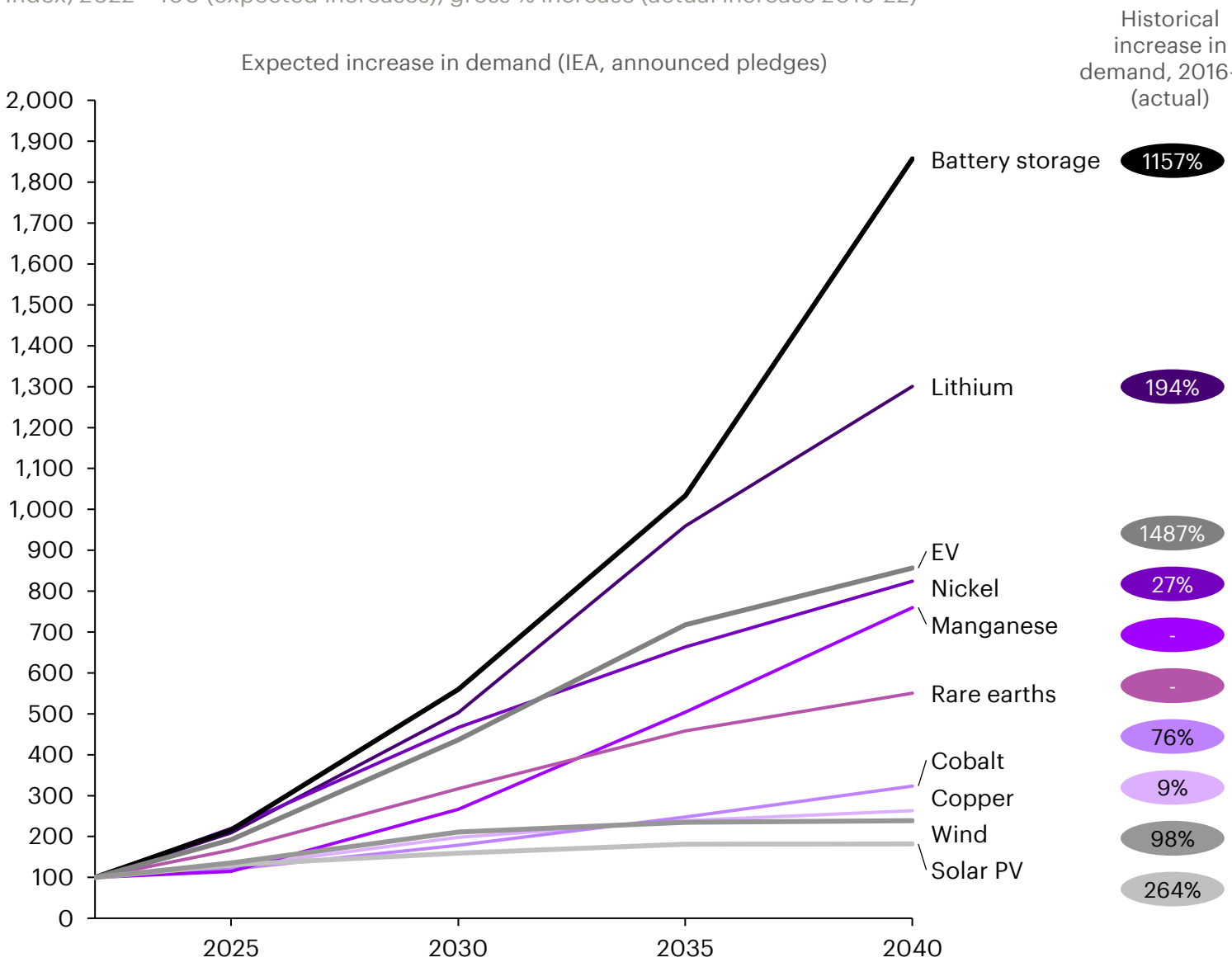
The rapid rise in demand is expected to continue to 2040, as the transition progresses. Under announced pledges, the IEA estimates a significant increase in demand for battery storage (18.6x) and EVs (8.6x), driving lithium, nickel and manganese demand up 13.0x, 8.2x and 7.6x.

These technologies will be needed continually in a decarbonised system, maintaining consistent demand as assets are repaired and replaced. In the long term, secondary markets for circular materials will become increasingly important to both ensure the system can be maintained sustainably and clean energy investors can achieve a return.

Sources: IEA (2023), Accenture (2023), Statista (2022), IEA (2023), IEA (2022), Jamasmie, C. (2018), Gordon, K. (2022)

Demand is rapidly increasing for clean energy technologies and their materials

Index, 2022 = 100 (expected increases), gross % increase (actual increase 2016-22)



In just two years, the opportunity for clean energy exports in prioritised industries has increased from $124b to $314b p.a. by 2040

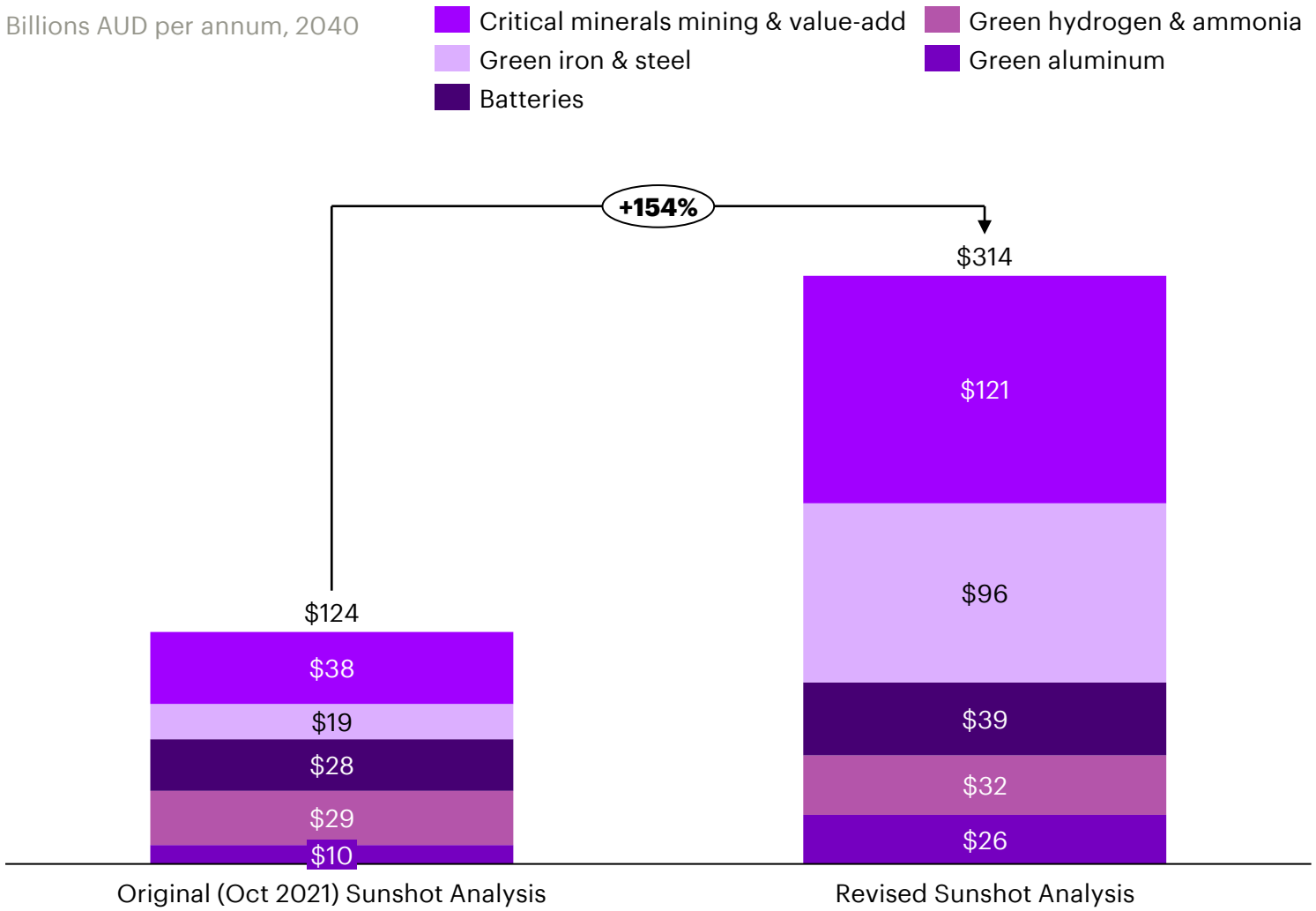
In 2021, the Sunshot Alliance identified over $100b of export revenue as achievable from clean industry. Since then, rapid growth in the energy transition and demand for clean energy materials has increased the potential for these exports.

Critical mineral demand has drastically increased in line with clean energy technologies – we also see increased potential for Australia to value-add downstream.The opportunity for green pellets and green iron has increased, due to the increasing demand to decarbonise steel globally and technical developments. A nascent but growing Australian battery industry supply-chain is developing, in response to increasing demand, and government has already indicated support in the space. Several key trading partners have set high hydrogen import targets in line with increasing industrial decarbonisation. Green aluminium is technically feasible and assuming Australia can buildout the renewable requirement this industry can prosper.

In a high ambition scenario, with policy support and sufficient renewable buildout, Australia should target $314b in revenue across these 5 priority industries.

Notes: Critical minerals include lithium, copper, nickel, cobalt, REE and manganese. Batteries includes active materials, cell & battery pack manufacturing, Green iron considers green pellets, iron and steel. Green aluminium includes alumina. Green hydrogen includes ammonia and assumes hydrogen for export is transported via ammonia. Source: See appendix for full source list and methodology, Accenture analysis

The opportunity has increased to $314b by 2040 in a high ambition scenario with policy support



5 clean export opportunities have been selected for analysis; this does not represent the limit of clean industry policy. The opportunities have been prioritised based on Australia's potential to be a global leader in exports of these goods. The focus for prioritisation is not on the opportunity from domestic markets or potential import substitutions.

Pursuit of the opportunity will transform Australia's economy to one that adds more value onshore, engages in advanced manufacturing and embeds decarbonisation

Transformational priorities

Value-add onshore

Australia has historically been a 'dig and ship' nation in many key materials. However, with increased demand for clean energy materials and a shifting global paradigm to developing sovereign capability, there is an increasing opportunity for Australia to build stronger capabilities downstream.

Investing in domestic processing capabilities can allow Australia to capture a larger portion of the value chain, thereby creating more jobs and retaining a greater share of the economic benefits within the country[1].

Develop manufacturing capability

Australia stands to benefit greatly from increasing its manufacturing capabilities. It can create high-skilled jobs, revitalise regional communities and strengthen potential supply chain vulnerabilities[1].

New clean industries and new trading blocs[2] present opportunities for countries who invest early to take leading positions. Advanced technologies such as batteries will be supported by countries with high technical skills and the ability to coordinate effectively across value-chains rather than just low-cost labour.

Embed decarbonisation

Australia has an abundance of solar and wind resources. If developed properly, Australia can produce materials which carry this lower cost of decarbonisation embodied.

Australia can support the world to meet emissions targets by shipping its embodied decarbonisation to countries which struggle to deploy renewables at the required scale or cost to meet targets.

Embedded decarbonisation will especially support the decarbonisation of hard-to-abate sectors like heavy industry.

Transformational ambitions

By 2040 Australia should:

- **Refine 60%** of critical minerals onshore.
- **Retain 30%** of iron ore for the manufacture of green iron and steel.
- **Retain 75%** of bauxite for alumina and aluminum.

By 2040 Australia should:

- **Develop 100GWh+** of advanced battery manufacturing capability.
- **Manufacture of 20mt p.a.** of steel.
- **Manufacture 5mt p.a.** of aluminum.

By 2040 Australia should:

- **Produce 15mt p.a** of green H_2 & ammonia to support industrial decarbonisation.
- **Produce 268mt p.a** of green direct reduced iron to decarbonise the global steel industry.
- **Produce 31mt p.a** of green alumina to decarbonise global aluminum.

Notes: This report focuses on five clean export opportunities, further value-adding, manufacturing and embedded decarbonisation opportunities may lay outside this scope. 1. Full job and economic value-added analysis undertaken in original Sunshot report (see source; Accenture, 2021), considering higher revenue estimations, we expect these numbers have increased. 2. Created from shifting geopolitics moving some countries to diversify their supply-chains away from current manufacturing leaders such as China. Source: Accenture (2021), Sanford, J. (2020), Buckley, T & Pollard, M (2023) Accenture analysis

However, the window of opportunity is closing fast as other countries invest heavily into clean industries and capture private investment

There is a global race for the private capital to build sovereign capability in clean energy industries. Governments around the world are making investments into clean energy technologies and their manufacturing.

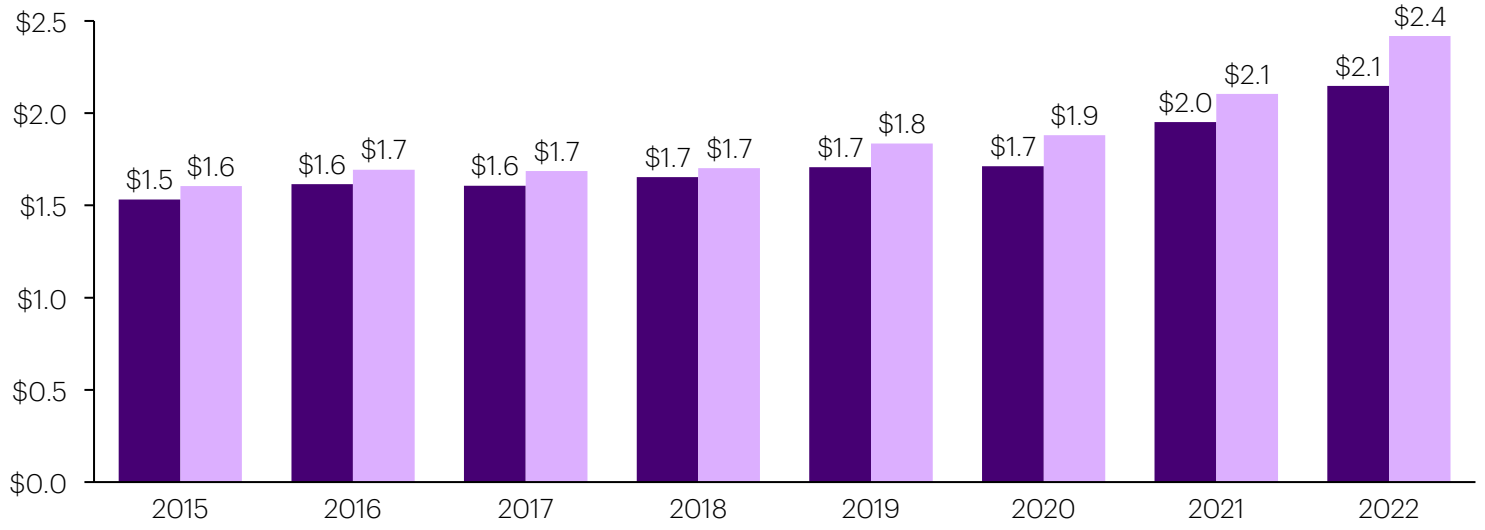
Increased public investment is catalysing private investment; over $400b of private clean investments have been announced in the U.S, in the year since the IRA's passage[1]. China has been a leader in incentivising private investment - $815b was spent on clean technologies there last year.

Australia is at risk of losing private capital offshore as private capital increasingly looks to make investments in regions where it will be supported by baseline public investments.

Notes: All figures are $AUD unless otherwise stated, 1. Based on announcements tracked by American Clean Power, 2. As reported in IEA Government Energy Spending Tracker, 3. In addition to the IRA, the U.S Infrastructure Investment and Jobs Act (IIJA) and CHIPs act make additional investments in clean energy and clean energy adjacent industries, 4. Due to the large expected uptake of clean energy technologies and the uncapped nature of US credits, estimated spend is higher than CBO estimates of US$380b.
Source: Whitehouse (2022, 2023), Credit Suisse (2023), Joyce, C. & Stanford, J. (2023), BloombergNEF (2023), EU Commission (2022), Government of Canada (2023), American Clean Power (2023), IEA (2023, 2023), Accenture analysis

Public investment in clean energy is increasing; catalysing even higher rates of private investment

AUD Trillion, investments in clean energy technologies



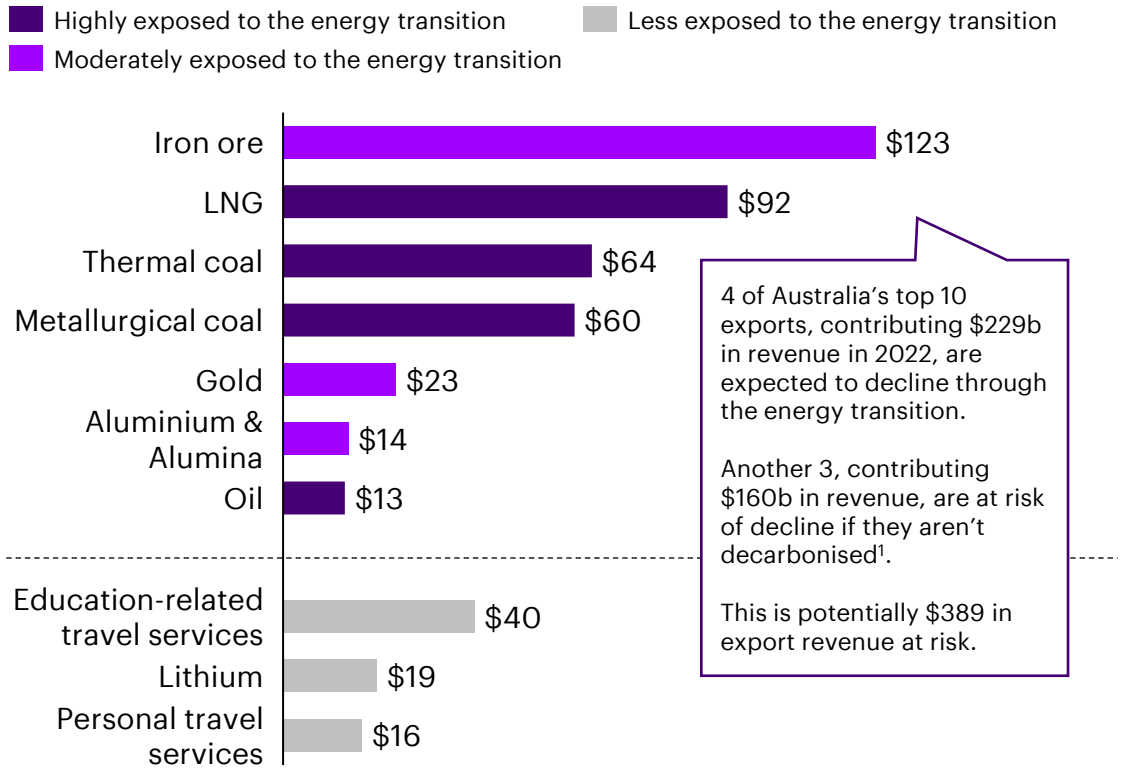
Example investments

U.S IRA[3]	• The US is spending $1.2t over 10 years (~$120b p.a) on clean electricity, manufacturing of clean technologies, transport, clean fuels, CCUS, electrification and climate readiness.[4] • This is set to increase private investments from the ~$210b already invested in 2022, with over $400b of new private investments announced since passage of the IRA[1].
China	• China has had successive industrial policies to develop dominant positions in the manufacturing of many clean technologies. • Policies have catalysed world-leading private investments – over $815b in 2022 - helping to build a clean tech manufacturing capacity 8-10x greater than North America and Europe combined.
Made-in-Canada	• Canada is spending $94b over 10 years across clean electricity, manufacturing of clean technologies (incl. critical minerals), hydrogen and CCUS. • Large private investment decisions are being spurred on, with Volkswagon investing in a $154m gigafactory development in light of battery manufacturing tax credits.

Without a response, Australia risks lower prosperity as current export revenues decline and potential future revenue from clean energy is lost to private capital moving offshore

Australia's current export revenue is at risk of decline

AUD Billions revenue from Australia's top 10 exports, 2022



Strong export industries are essential to Australia's prosperity –adding jobs, value and increasing the tax base to support our public institutions and services.

A total of $389b in at risk revenue needs to be replaced or de-risked.

Revenue needs to be replaced with sustainable export industries to secure Australia's ongoing prosperity; however, this is being incentivised offshore...

CASE STUDY

Pilbara Minerals is taking lithium hydroxide refining to South Korea
Pilbara Minerals and POSCO secured $682 million in funding from government owned banks to construct a lithium hydroxide plant in South Korea. The plant will source spodumene from Pilbara Minerals' lithium mines in WA however have chosen to conduct value-adding activities offshore due to this government support. The announcement makes Pilbara minerals the 2nd company to move lithium refining offshore this year, with Liontown Resources Ltd exploring Lithium refining in Japan.

CASE STUDY

H2 Green Steel is investing with Rio Tinto and Vale in Canada and Brazil
Companies such as H2 Green Steel have made several investments in regions where government support is backing green steel and the clean energy technologies its used in. This includes partnering with Rio Tinto in Canada and Vale in Brazil for the production of green pellets and iron. Iron ore reserves in Canada and Brazil are better suited to green iron than Australia, without policy support to allow Australia to compete on lower cost hydrogen, we will lose out in this race.

CASE STUDY

Fortescue Future Industries has purchased the $35m Phoenix Hydrogen Hub
FFI has been quoted as "actively expanding its US presence" off the back of U.S IRA production tax credits for green hydrogen. They have recently acquired the Phoenix Hydrogen Hub (PHH) with the planned 80MW electrolyser producing up to 12kt of green hydrogen. CEO Mark Hutchinson has cited that incentives combined with access to domestic and export off-take agreements are key considerations in identifying markets to operate in.

Notes: 1. iron ore will increasingly need to be green to be used as an input into green steel production, as will alumina & aluminum. Gold is a high embodied emissions good. See further assessment in the original Sunshot report. Source: Accenture (2021), Department of Industry, Science and Resources (2023), Resources and energy quarterly: June 2023, Government of Canada (2023), Ker, P. (2023), Ker, P. (2023),

Australia needs a comprehensive policy response across four clean energy policy pillars to capture the opportunity

Australia needs an ambitious & comprehensive clean energy policy to both enable the 5 prioritised clean export industries and meet wider decarbonization targets.

The other jurisdictions assessed in this report for comparative clean energy policy have all taken this overarching approach.

A comprehensive policy approach is more effective as it:

- Reduces the risk of potential delays and supply-shortages through synergy and coordination (i.e. ensures there is the required clean energy for clean industry and, in turn, the right materials for clean energy).
- Simplifies messaging of government intent and direction for people and businesses – leading to stronger uptake of policies and ongoing political support.
- Provides confidence for the private sector to invest
- Ensures that all aspects of the energy transition are being addressed and all groups are being included, supporting a just and sustainable transition.

Notes: 1. Further assessment of non-prioritised clean industry opportunities provided in section 3. Source: Accenture analysis

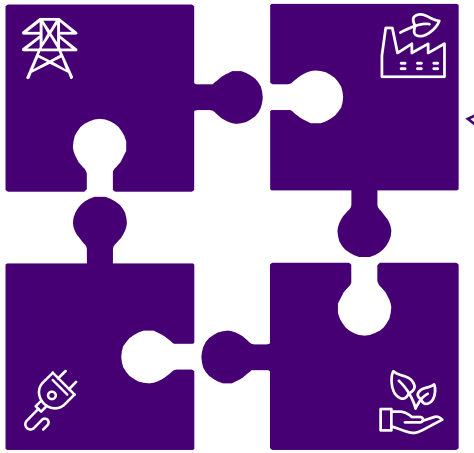
Australia needs an overarching clean energy policy that addresses four mutually reinforcing pillars

1. Renewable buildout that's good for workers, nature & communities

Investments to facilitate renewables at the speed and scale required for clean industry and domestic use while benefiting nature, meeting community expectations & benefits and supporting high quality, secure jobs & training opportunities.

2. Clean industry & exports policy

Direct investments and policy support to build capabilities in clean energy industries, to capture the economic opportunity from the energy transition and transition Australia's export economy to become world-leading in clean energy industries.



This report makes detailed comment on 5 prioritised clean export opportunities. Further analysis is required for other non-prioritised clean industries and policy in the other three pillars[1].

3. Widespread electrification

Investments in electrification and energy efficiency to support decarbonisation targets and drive demand for clean industry.

4. Climate & transition readiness

Investments to avoid & prepare for adverse climate events and policy to support a just transition with a focus on community benefit. First Nations should be directly involved.

Proportionally, peers are investing up to $80b across the four pillars, with the potential to catalyse more in private investment

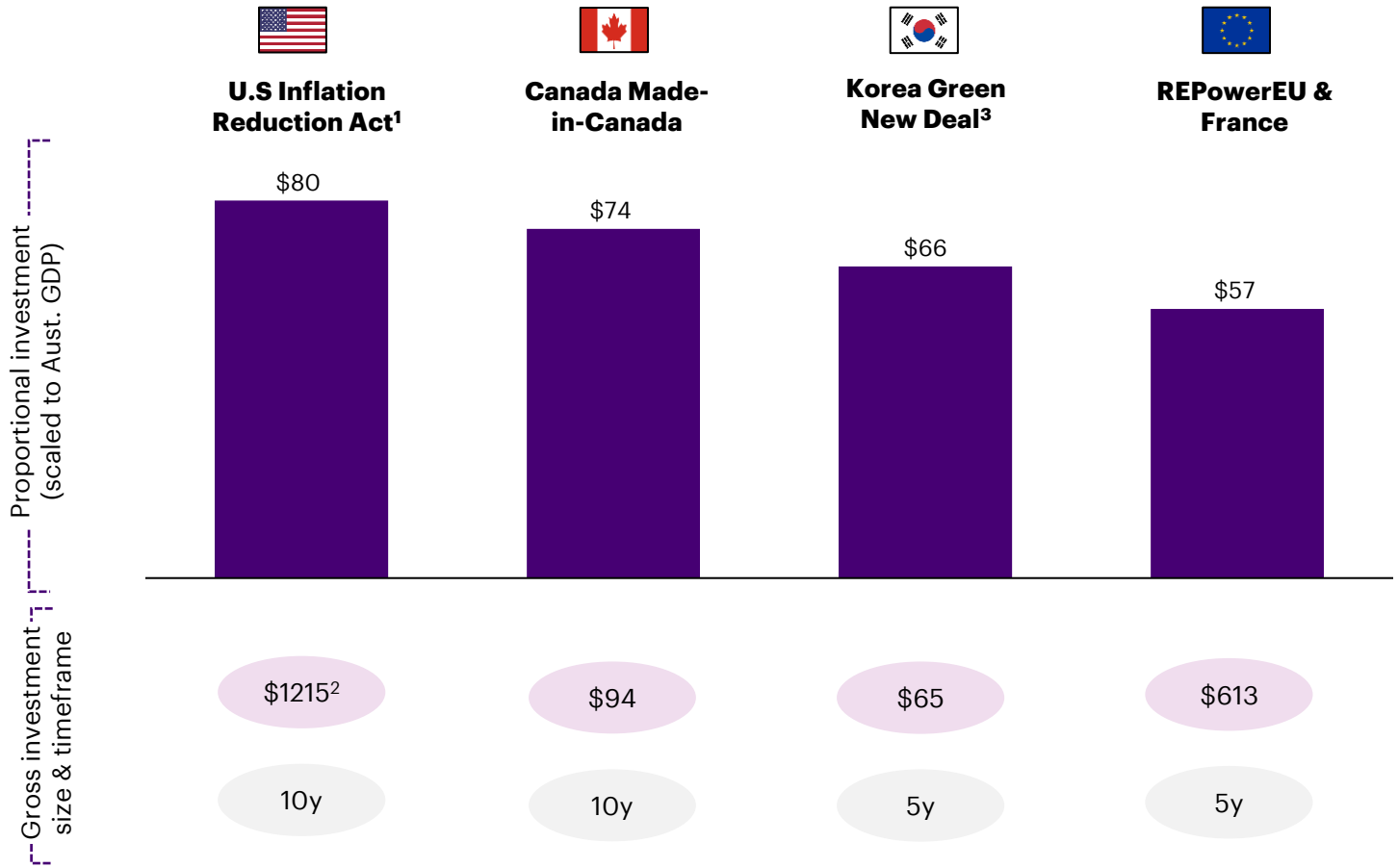
The U.S, Canada, Korea and EU have all implemented policies that address all four pillars of clean energy policy; renewable buildout, clean industry policy, widespread electrification and climate & transition readiness.

The U.S is investing $1215b on the four clean energy policy pillars, the equivalent of 3.2% of its GDP. The proportionate investment based on Australia's GDP would be $80b. Canada, Korea and Europe are investing 2.9%, 2.6% and 1% respectively.

Notes: All figures AUD unless otherwise stated. *Considers investment as a proportion of a countries GDP and applies this to Australia's GDP, converted to AUD. U.S investment is USD$800B (3.2% GDP), Canada USD$71B (2.9% GDP), Korea USD$44B (2.6% GDP), Europe & France USD$411 (1% GDP). AUD:USD = 0.67.1. In addition to the IRA, the U.S Infrastructure Investment and Jobs Act (IIJA) and CHIPs act make additional investments in clean energy and clean energy adjacent industries, 2. Considers a higher uptake of uncapped credits than the $380b USD estimated by the congressional budget office. 3. Gross and proportionate size of Korea's investment is similar due to similarities with Australian GDP. Source: Whitehouse (2022), Credit Suisse (2023), Joyce, C. & Stanford, J. (2023), EU Commission (2022), Government o2023f Canada (2023), Korean Ministry of Economy and Finance (2020), World Bank GDPs (2023), ARENA (2023) Accenture analysis

Peers are investing heavily across clean energy policy and catalysing private investment

Billions AUD scaled to Aust. GDP*, billions AUD



Note: *This only considers the public investments made by each country, further private investment is being catalysed in each. Over $400b of announcements have already been made since the passage of the $1.2t IRA.*

International investments are related to the full scope of policy pillars; renewable energy buildout, clean industry & exports, widespread electrification and climate & transition readiness.

Australia must invest in renewables buildout as a priority; it is the key foundational requirement for clean exports

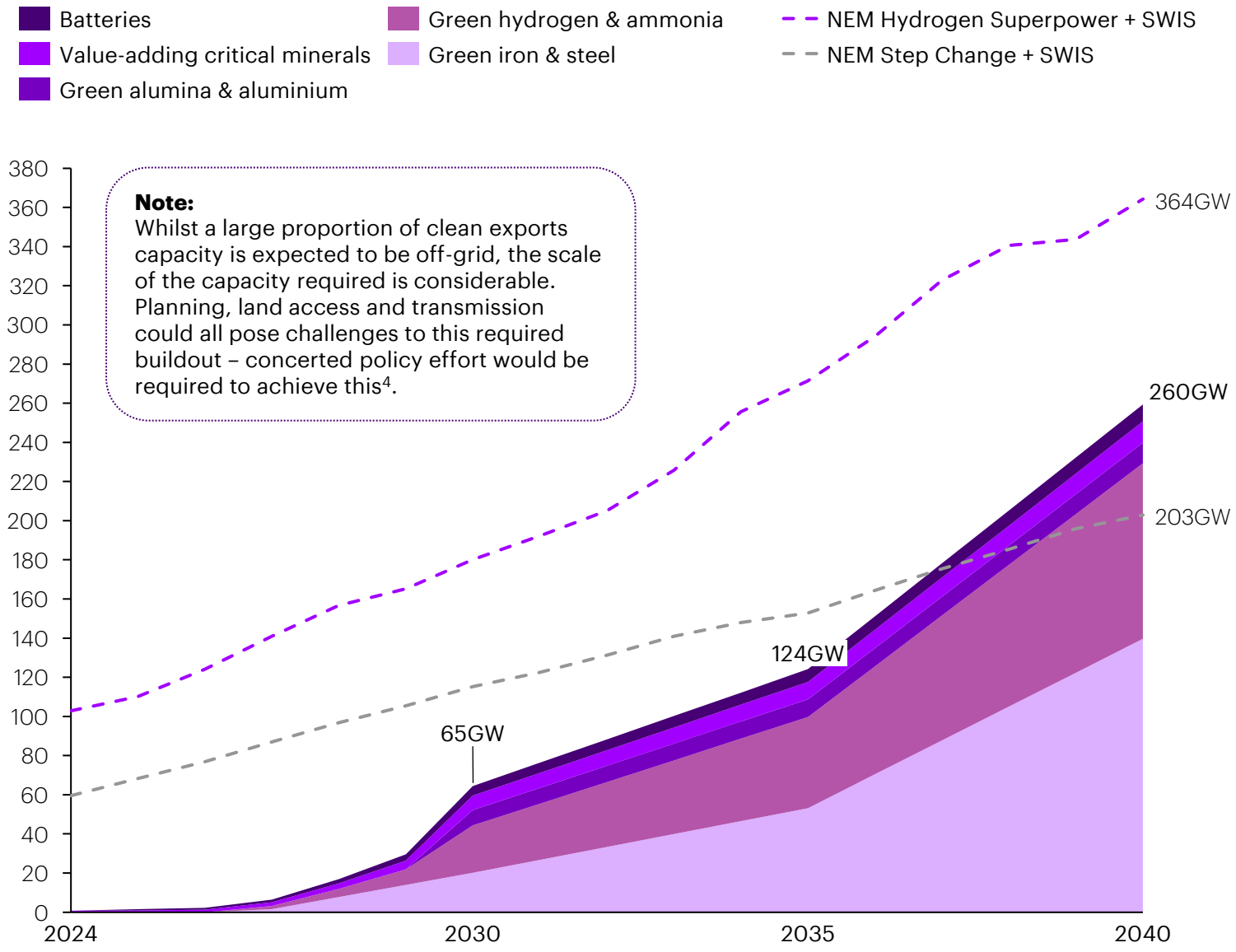
A large portion of international clean energy policy is focussed on sufficient renewable buildout. This will also be vital in Australia both to meet national decarbonisation targets and ensure the entire value chain of the export industries are powered by renewables.

Significant renewable energy capacity will be required to enable the 5 export industries. This is especially critical for green hydrogen as well as green iron and steel, as both are highly energy intensive and contingent on access to low-cost and reliable renewable energy.

Australia will need to increase the speed and scale of its renewable buildout in line with trajectories following an exports scenario. Current challenges to renewable buildout such as transmission, inefficient & ineffective assessments and approval decisions, community concern and lack of storage will need to be overcome. Australia's renewable energy build-out will need to evolve in line with both domestic and export needs[1].

Notes: 1. See further discussion on how to address challenges in renewable energy buildout in section 3. 2. Projections from the AEMO 2022 ISP have been used as the full 2024 ISP Report has not yet been published at the time of writing. 2023 IASR and ESSO forecasts do not include additional capacity requirements by technology i.e. renewable vs non-renewable (estimates are for consumption). The renewable energy requirement for green iron and steel assumes a decarbonised value chain from mining to processing. SWIS considers capacity additions under a Techtopia scenario in the WA 2020 WOSP. Sources: IEEFA (2020), MRIWA (2023), Alcoa (2022), AEMO (2022, 2023, 2023), DISR (2023), ARENA (2017), Kelly, J. C., Wang, M., Dai, Q., & Winjobi, O. (2021), Northey, S. A. & Haque, N. (2014), Energy Transformation Taskforce (2020)

The 5 selected Clean export industries will require significant renewable energy capacity



Local content in renewable buildout can drive clean industry demand & increase renewable capacity through a positive feedback loop

Renewable energy buildout will create demand for clean energy materials - for example utility-scale solar and onshore wind will require large amounts of green steel, aluminium and critical minerals. Additional demand will come from other clean energy technologies such as offshore wind, rooftop & thermal solar and electrolysers.

Batteries, and their embedded materials, will also be required at scale domestically (around 43GW of additional storage capacity will be required to 2040[1]).

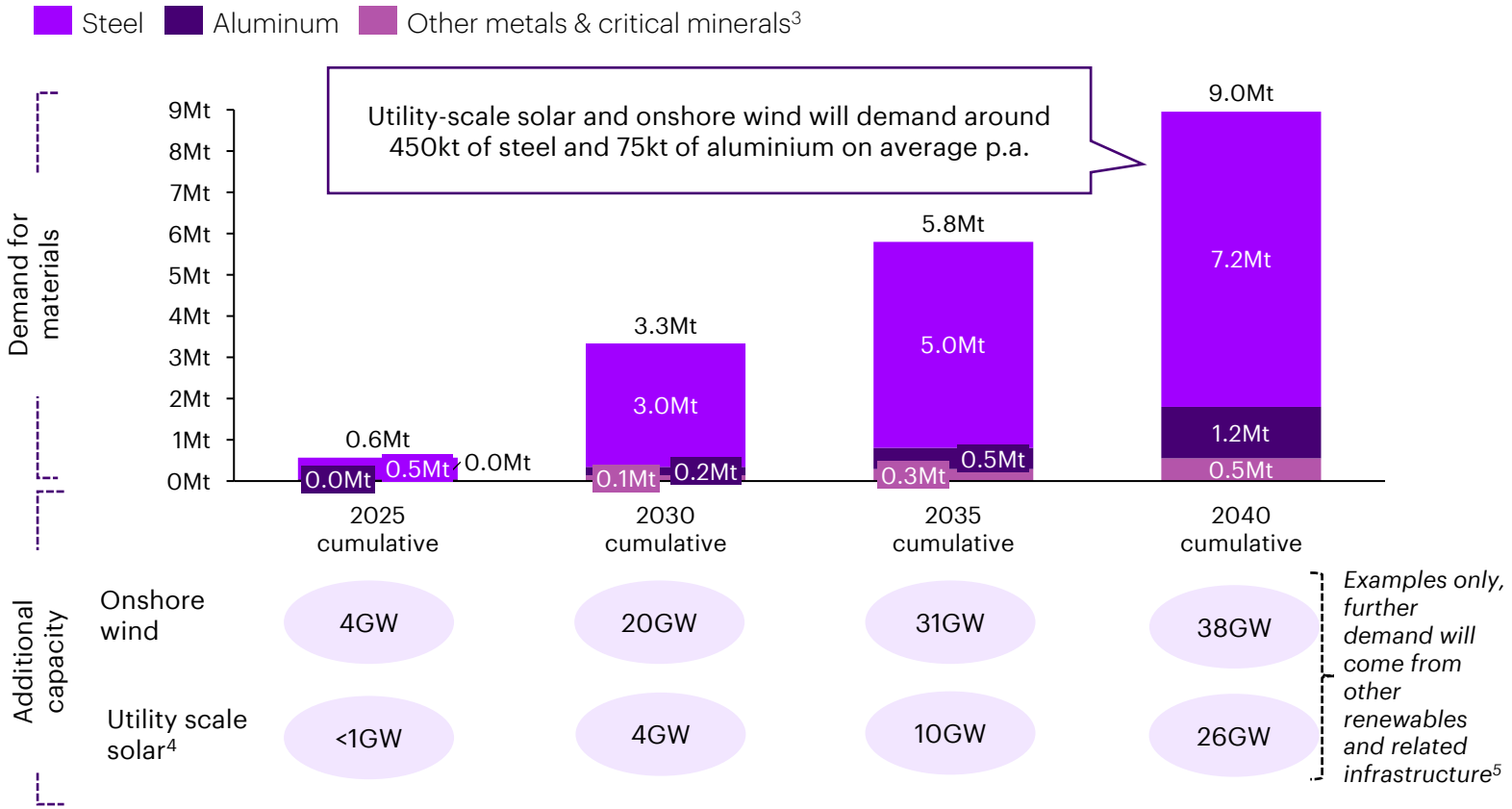
Linking renewable energy buildout to requirements or incentives for local content will direct this demand towards local producers, supporting domestic offtake for the clean export industries. Further, this creates a positive feedback loop as the domestic clean material industries also drive demand for renewables.

Local content requirements should be considered in policy design for the renewable energy. For example, additional incentives could be provided for renewable developers if local content is used.

Notes: 1. including both utility scale and distributed storage (AEMO Step Change), 2. steel, aluminum and critical mineral requirements for wind and solar taken from meta-analysis of estimates from Liang, Y et al. 3. includes; copper, nickel, silicon, zinc, molybdenum, manganese and others. 4. does not include solar thermal or distributed PV, 5. For example transmission and distribution infrastructure and storage, 6. For example, Victorian Local Jobs First Policy, NSW RESB. Source: Liang, Y et al. (2022), AEMO ISP Step Change (2022, 2023, 2023), Whitehouse (2022), EU Commission (2022), Accenture analysis

For example, solar and wind buildout can generate over 9mt of metals and minerals demand

Million tonnes of metals and minerals[2], GW of solar and wind capacity, both cumulative to 2040



Domestic local content requirements can link renewable energy buildout policy with clean industry policy by ensuring the demand for clean energy materials is directed towards domestic producers. This can be done though requirements or incentives linked to renewable energy buildout policy, for example:

- The US IRA increases the tax credit available to renewable energy developments for use of local content (10% increase on the credit if 40% of materials are domestic),
- The EU mandates that 40% of clean energy materials must be made domestically by 2030,
- Some Australian State Governments use a points-based system for public tenders, providing an allocation of points for domestic content to drive its selection[6].

In tandem with renewable buildout, Australia needs a globally ambitious, proportionate and targeted clean export industry policy

In addition to policies supporting renewable energy buildout as a foundation, and other electrification and climate readiness policies, direct support is required for clean export industries.

This report focusses on 5 prioritised clean exports within this policy pillar; critical minerals, green iron & steel, battery manufacturing, green hydrogen and green aluminum.

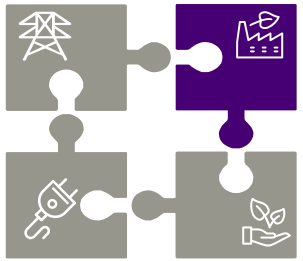
Direct policy support for these industries is especially important to offset the progressive loss of export revenues from Australia's already highly-exposed fossil-fuels export portfolio[1].

Policy should be designed to meet 4 principles; globally ambitious and proportionate, targeted on challenges to investment and building capability, built on clean energy and supporting decarbonisation outcomes and ensures workers, communities and the environment share in new value created.

Notes: 1. 8 out of Australia's top 10 exports are exposed to the energy transition – see further analysis in the original Sunshot report. Source: Accenture (2021), Accenture analysis

Australia should design its clean export industry policy on a set of 4 principles

Policy Priority



Clean exports industry policy

The following guiding principles should be considered for the clean exports industry pillar of an overarching clean energy policy. This reports detailed policy analysis considers 5 prioritised exports within this pillar. It does not suggest policy for other clean industries or for the other policy pillars (renewable energy buildout, electrification or climate & transition readiness)*.

Guiding Principles

01 Globally ambitious & proportionate

- Investment should seek to place Australia in a competitive, leadership position for the 5 prioritised export industries.
- This will require a proportionate response to international policy interventions (considering the impact of investment location and relative cost comparisons).

02 Targeted to unleash private investment, address challenges & build capability

- Policy design should be targeted towards overcoming challenges to investment in the clean export industries, with the goal of catalysing private investment.
- Policy should also build long-term capability to ensure that clean export industries can build sustainable competitiveness post-policy support.

03 Built on clean energy and supporting decarbonisation outcomes

- Development of export industries should consider their renewable requirement and how this interacts with other requirements, supporting additionality and ensuring Australia can meet decarbonisation targets.
- The substitution of our current fossil-fuel exposed exports to clean exports will significantly reduce scope 1 & 2 emissions – ensure this net impact is considered when designing overarching clean energy policy.

04 Ensures workers, community & the environment share in new value created

- Similar to the IRA, Australia should design policies in such a way to work towards societal and environmental benefits.
- This includes ensuring fair labour standards & Indigenous rights are upheld, designing for community benefit and Just Transition and ensuring clean industry policies help build a nature positive Australia.

**Further analysis is required into policy design for other potential industries and other clean energy policy pillars.*

A $38b clean export industry investment to 2034, across the 5 prioritised industries, can deliver the right settings to catalyse private capital and support the $314b opportunity

Policy objectives & mechanisms	Address short-term challenges Remove the immediate constraints to investment in clean export industries	Build long-term capability Create opportunities for clean exports to reach greater efficiency & scale	Raise ambition and win Proportionally re-level the playing field and realise the full clean exports opportunity
	Robust, fair, timely & community driven assessments & approvals[1]	Skill programs – NZA[2]	Production incentives (CFD or tax credit)
	International cooperation	Priority status in assessments & approvals for onshore value-add[1]	Hydrogen inputs incentives (CFD or tax credit)
	Government procurement	Strengthening and co-investing in Australia's R&D ecosystem	
		Funding industrial precincts – NZA[2]	
Investment			
2024-30:	$2.3b	$7.8b	$12.7b
2030-34:	$1.9b	$0.8b	$12.1b
Total:	**$4.2b**	**$8.6b**	**$24.8b**

Investment funding should be delivered over two stages; $23b between 2024-30 with a second stage investment of $15b to 2034.

This investment is related to five prioritised industries in the clean exports policy pillar only. Further assessment is required for policy actions in other pillars of Australia's clean energy policy.

*Pursuing investments across **all three objectives** will support Australia to meet its 2040 high ambition targets:*

- **$121b of value-adding critical minerals revenue** with ~60% from refining
- **$96b of green iron & steel revenue** producing 268mt of green iron p.a. **$26b of aluminium revenue** producing 5mt p.a.
- **$39b of batteries revenue** with 111GWh of manufacturing capacity
- **$32b of green hydrogen revenue** producing 15mt p.a.

Notes: 1. All policy analysis regarding assessments and approvals ensure that all current environment and regulatory requirements will only be enhanced. 2. Net Zero Authority, 3. Contracts for difference have been selected as an efficient and effective mechanism to deliver credits, however other mechanisms such as production tax credits can also be used to provide this. 4. Green iron & steel only – not aluminum - focused on incentivizing the required hydrogen for the green iron and steel opportunity, not production of green iron and steel. Further detail provided in appendix. Source: See appendix for full source list and methodology, Accenture analysis

The $38b of public investment will crowd in further private investment; this could be 2.8x the initial public investment or more

The policy mechanisms used to deliver the $38b public investment, can support private capital to direct investments towards Australia; this is estimated at a baseline of 2.8x – actual private investments could be even higher considering recent national and international experience

AUD Billion

Mechanisms to address short-term challenges will create immediate opportunities for private investments and increase the ease of executing those investments in Australia through:

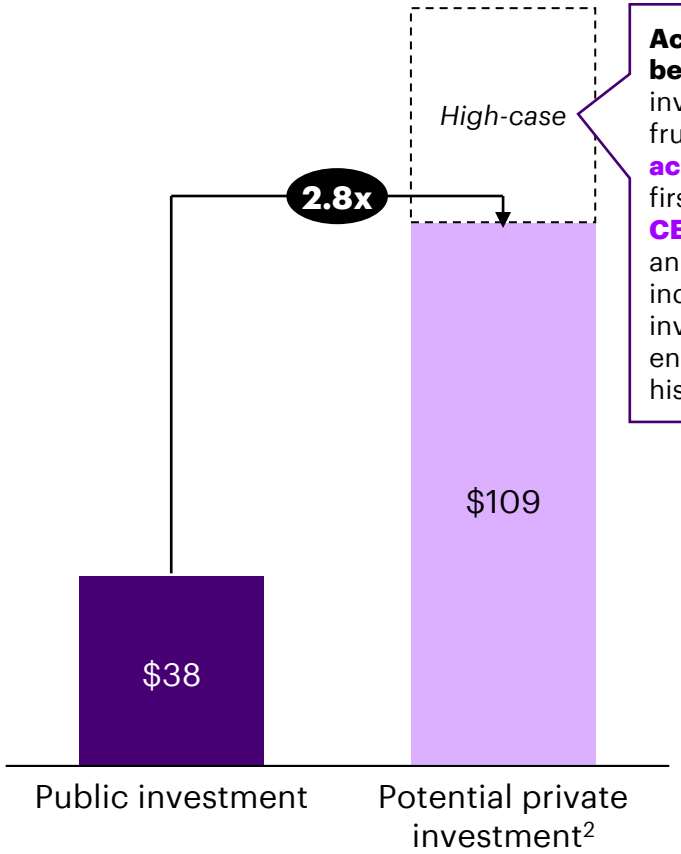
- Creating reliable sources of immediate domestic offtake,
- Reducing the time taken to deliver projects whilst ensuring fair outcomes for the environment, community and proponents, and,
- Reducing international barriers to trade.

Mechanisms to build long-term capabilities, can ensure that Australia remains a good place to do business overtime reducing cost of production though:

- Economies of scale through shared infrastructure and priority access to raw material feedstock,
- A strong and capable workforce delivering high quality products and,
- A strong R&D ecosystem increasing productivity through innovation and knowledge spillovers.

Mechanisms to raise ambition and win, will ensure investors can meet the same, or better, levels of returns in Australia considering the international environment through:

- Targeted & dynamic[1] production incentives that consider Australia's costs of production in relation to competitors for private capital
- Targeted & dynamic[1] input incentives that ensure hydrogen can replace fossil fuels economically in green iron & steel.



Actual private investment could be even higher; if announced investments in the U.S come to fruition, the **IRA will have achieved a 3.3x multiplier** in its first year. Closer to home, the **CEFC multiplier was 5x in 2023**, an all-time high. These both indicate trends that private investment multipliers in clean energy are trending higher than historic averages.

Notes: 1. Mechanisms such as contracts for difference can deliver incentives in a way that is targeted & dynamic in that public funding is only provided to projects that reach production of the desired good and the per unit incentive reduces in line with cost of production/green premium reductions, it may result in a higher proportion of private investment to public overtime. 2. See private investment catalysed methodology in appendix. For Raise Ambition & Win (production incentives) investment, the proportion of private investment required in critical mineral, battery, green iron & steel and hydrogen projects considering public subsidization is assessed. For all other investment mechanisms typical fiscal multipliers seen in historic global (Credit Suisse) and Australian experience have been used (ARENA & CEFC). 4. considering $400b of announced U.S investments and an average p.a. IRA public investment of $121b. Source: Source: Credit Suisse (2023), ARENA (2023), CEFC (2023), Accenture analysis

This public investment would be globally ambitious for the scope considered and can place Australia in a leading position against peers

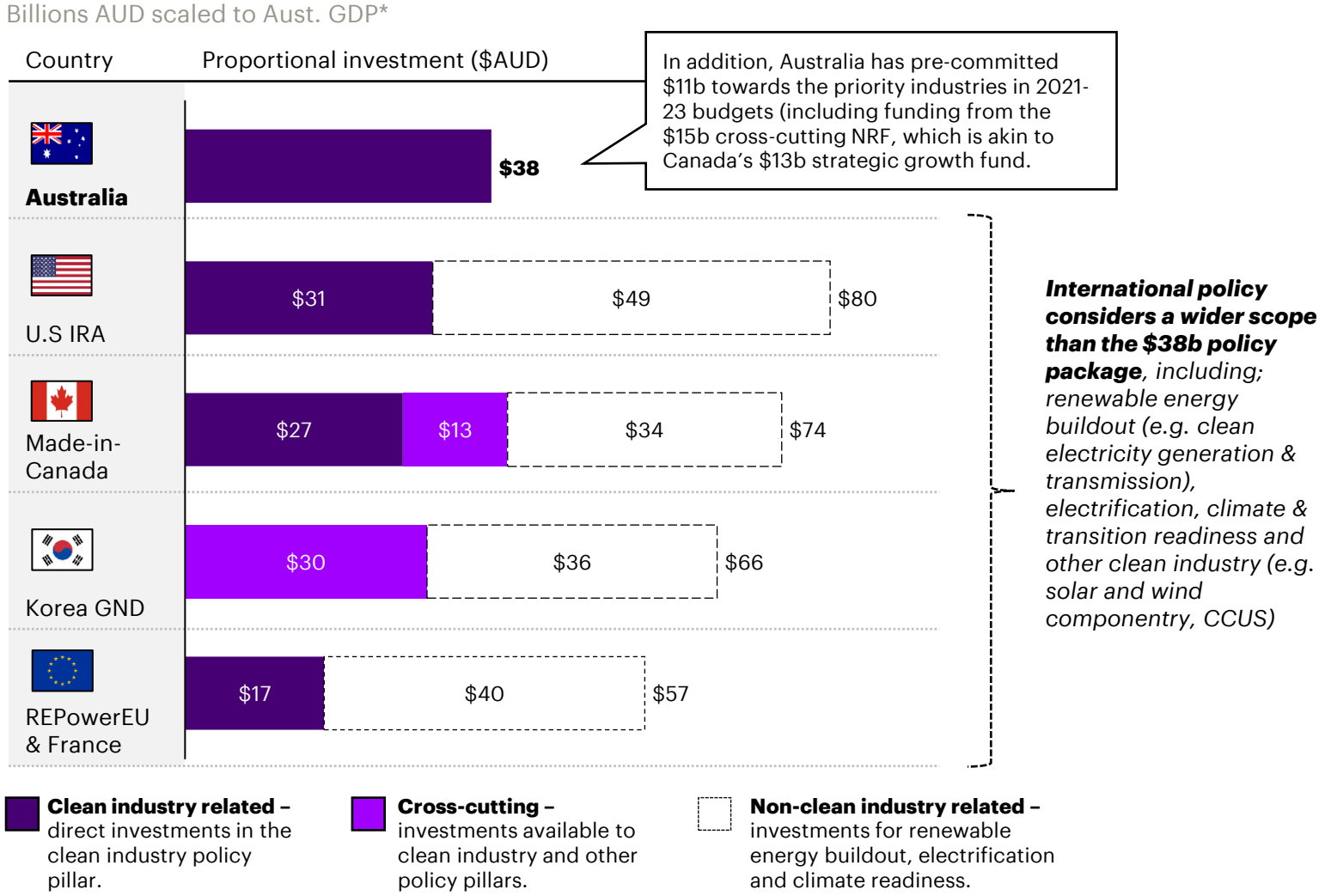
Australia's comparative investment in the selected scope should be targeted to ensure Australian competitiveness and based on consideration of a proportionate response necessary to achieve that goal. The $38b public investment is built on such a response and considers what Australia's industries specifically require in the new landscape.

This investment should be considered in concert with already committed funding for the clean export industries, which has been $11b over 2021-23 budgets. The total investment would position Australia as a global leader in clean industries and help secure our economic prosperity in a low-emissions world.

Pre-committed funding includes; National Reconstruction Fund investment into advanced manufacturing, critical minerals & decarbonisation of industrial facilities, the Hydrogen Headstart program & other hydrogen investments, EFA & NAIF loans for critical minerals facilities and Powering the Regions investment into sovereign steel & aluminum.

Notes: * Considers investment as a proportion of a countries GDP and applies this to Australia. See appendix for breakdown of pre-committed funding and methodology for Australian investment sizing. See section 2 for breakdown of international investments. 1 Canadian pre-cross-cutting funding is for a Strategic Investment Fund investing into both clean industry and renewable buildout through contracts for difference. Similar in size and scope to the National Reconstruction Fund. Source: Whitehouse (2022, 2023), Credit Suisse (2023), Joyce, C. & Stanford, J. (2023), European Commission (2022), Government of Canada (2023), Korean Ministry of Economy and Finance (2020), World Bank (2023), Australian Government (March 2022, October 2022, May 2023), Accenture analysis

This policy package places Australia as a global leader in public clean exports investment



Clean industry related – direct investments in the clean industry policy pillar.

Cross-cutting – investments available to clean industry and other policy pillars.

Non-clean industry related – investments for renewable energy buildout, electrification and climate readiness.

Note Australia's investment is related to the 5 selected clean exports only.

Further assessment is required for policy actions outside of these industries and in other pillars of Australia's clean energy policy (e.g. renewable energy buildout, electrification and climate & transition readiness.)

Policies should ensure fair working environments, a just transition, community benefit and First Nations partnership through requirements, standards and additional incentives

Outcomes	*How other nations have done this*	*How Australian policy could do this*	*What this looks like in Australia*
Safe and secure jobs with fair labour standards	**Canada Clean Industry Tax Credits:** Wages must follow the most recent multi-employer collective bargaining agreement & 10% of the labour hours must be performed by apprentices. **US IRA Prevailing Wages and Apprenticeships:** IRA tax credits are increased 5x for providing wages at prevailing rates for a similar character of work and allocating hours for apprentices.	• *Production & input incentives and government procurement:* require that projects must meet fair labour standards guaranteeing well-paid, safe, and secure jobs in order to receive incentive or tender	CASE STUDY **Inclusive hiring, training and fair wages at Geelong Big Battery** Construction firm UGL completed the Geelong Big Battery on time & budget while engaging a diverse workforce and delivering training & apprenticeship opportunities under wages & conditions negotiated with the Electrical Trades Union. 'Top up' labour during peak periods was sourced via a local contracting business with a union agreement, further benefiting local workers & the community.
A just transition for fossil fuel reliant communities	**Spain's Just Transition Agreements:** Workers, local government and communities are creating clean energy job banks, ecological restoration projects employing former coal workers, and prioritising investment in local renewable projects. **US IRA Energy Communities**: IRA tax credits receive a 10% bonus for projects in communities with high employment or a significant revenue from fossil fuels.	• *Production & input incentive:* provide bonuses to the incentive for projects located in transitioning regions as designated by Net Zero Authority • *Government procurement:* provide preferred provider status for projects located in transitioning regions	CASE STUDY **Gladstone's 10-year energy transition plan** Historically a centre for fossil fuel production and exports, the regional council of Gladstone has unveiled a 10-year energy transition roadmap and seeks to ensure equitable distribution of the resulting benefits across its community. A new apprentice training hub is being established as part of the Queensland Energy and Jobs Plan (QEJP).
Shared benefit for communities and First Nations	**US IRA Low-income & Indigenous Communities Credit:** IRA tax credits receive a 10% bonus if project is on indigenous land or in a low-income area, increases to 20% if the project is part of federal subsidised housing programs or offers at least 50% of financial benefits of energy produced to low-income households	• *Production & input incentives and Government procurement:* provide bonuses to the incentive or preferred provider status for projects with community benefits sharing arrangements • *Net Zero Authority standards:* for community & First Nations engagement[1]	CASE STUDY **The East Kimberley Clean Energy Project** In collaboration with Pollination Group and the Kimberley Land Council, traditional owners of the land MG Corporation and Balanggarra Aboriginal Corporation are spearheading the integrated development process using true co-design and co-decision making to reduce project development risk and shorten the development schedule.

Notes: See further information on the policies which consider additional incentives in the appendix. 1. This could reference best practice guidelines such as the First Nations Clean Energy Network Best Practice Principles for Clean Energy Projects. Sources: Whitehouse (2022), Government of Canada (2023), IEA (2021), Pollination Group (n.d.), First Nations Clean Energy Network (2022), Accenture (2023), Stakeholder consultation, Accenture analysis

Contents

The pace of the global energy transition is increasing, driving greater demand for clean energy technologies and their materials

Countries are increasing their ambitions to decarbonise; the globe's largest economies have net zero targets, many including interim 2030 targets. This has driven a significantly higher demand for clean energy technologies and their critical minerals.

For example, over the last 5 years, EV and battery demand has grown over 10x, diving an increase in lithium and cobalt demand of 194% and 76%. The rapid increase in demand has often outpaced supply, leading to record high lithium prices in 2022.

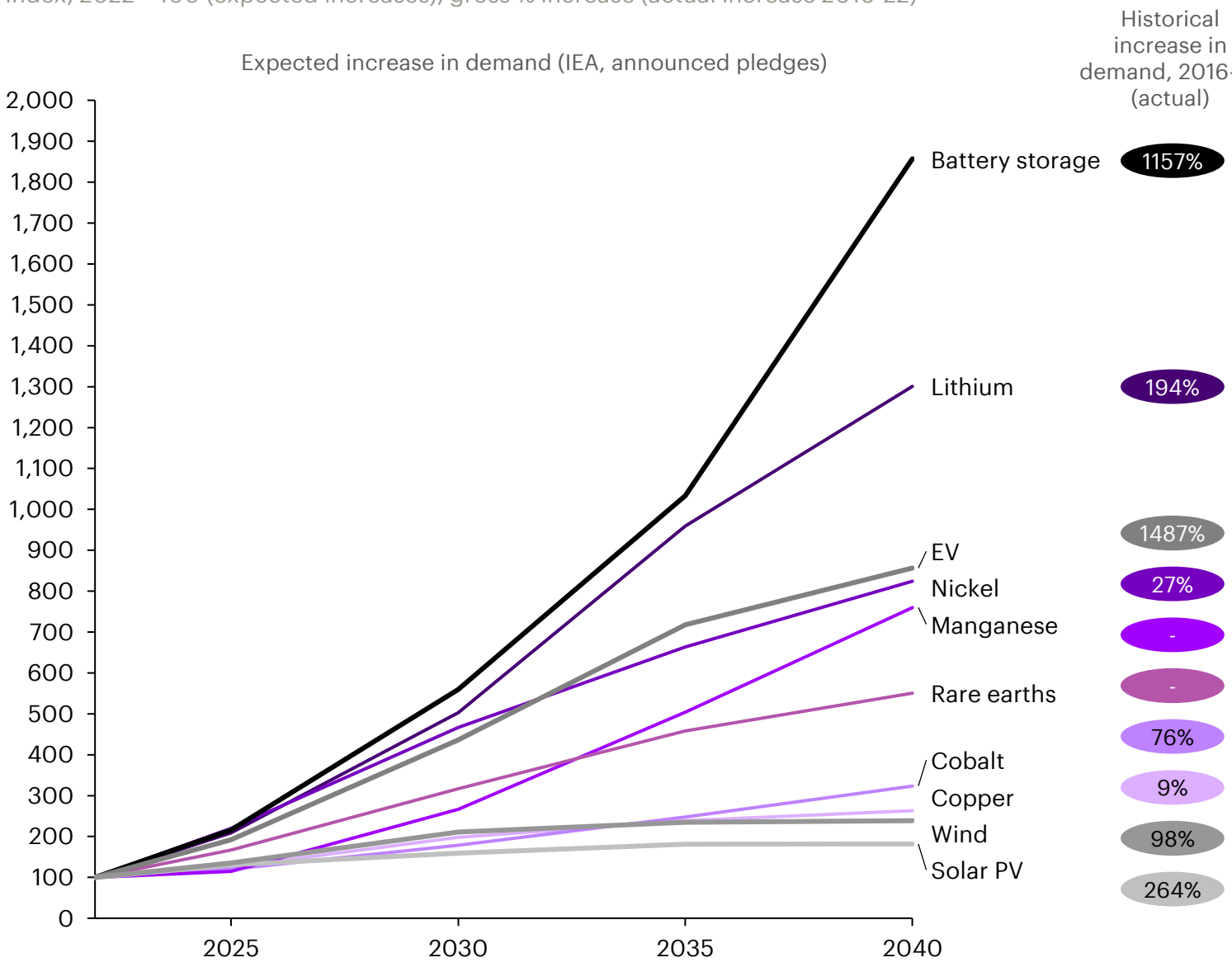
The rapid rise in demand is expected to continue to 2040, as the transition progresses. Under announced pledges, the IEA estimates a significant increase in demand for battery storage (18.6x) and EVs (8.6x), driving lithium, nickel and manganese demand up 13.0x, 8.2x and 7.6x.

These technologies will be needed continually in a decarbonised system, maintaining consistent demand as assets are repaired and replaced. In the long term, secondary markets for circular materials will become increasingly important to both ensure the system can be maintained sustainably and clean energy investors can achieve a return.

Sources: IEA (2023), Accenture (2023), Statista (2022), IEA (2023), IEA (2022), Jamasmie, C. (2018), Gordon, K. (2022)

Demand is rapidly increasing for clean energy technologies and their materials

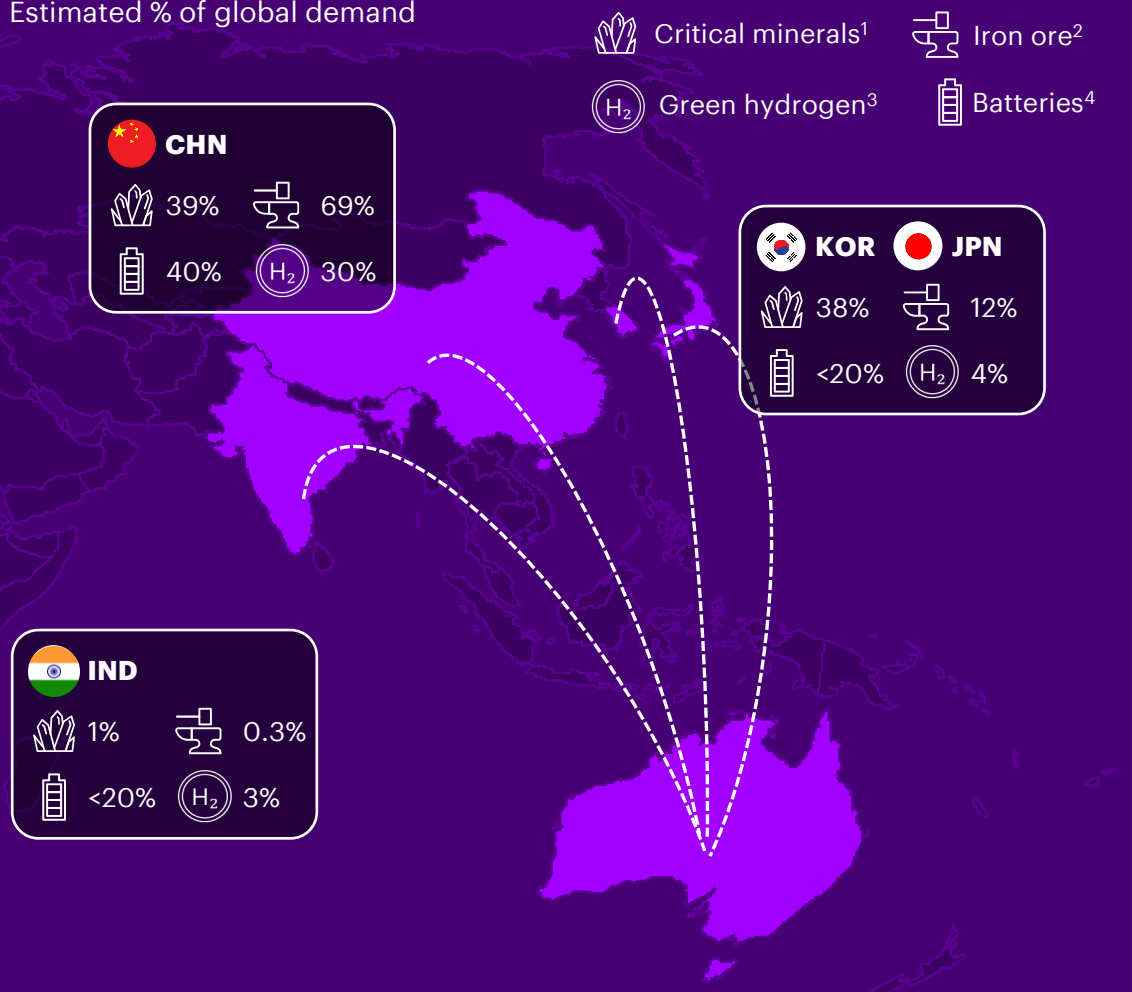
Index, 2022 = 100 (expected increases), gross % increase (actual increase 2016-22)



Australia is well-placed to capture this opportunity due its proximity to key demand as well as endowment of mineral resources

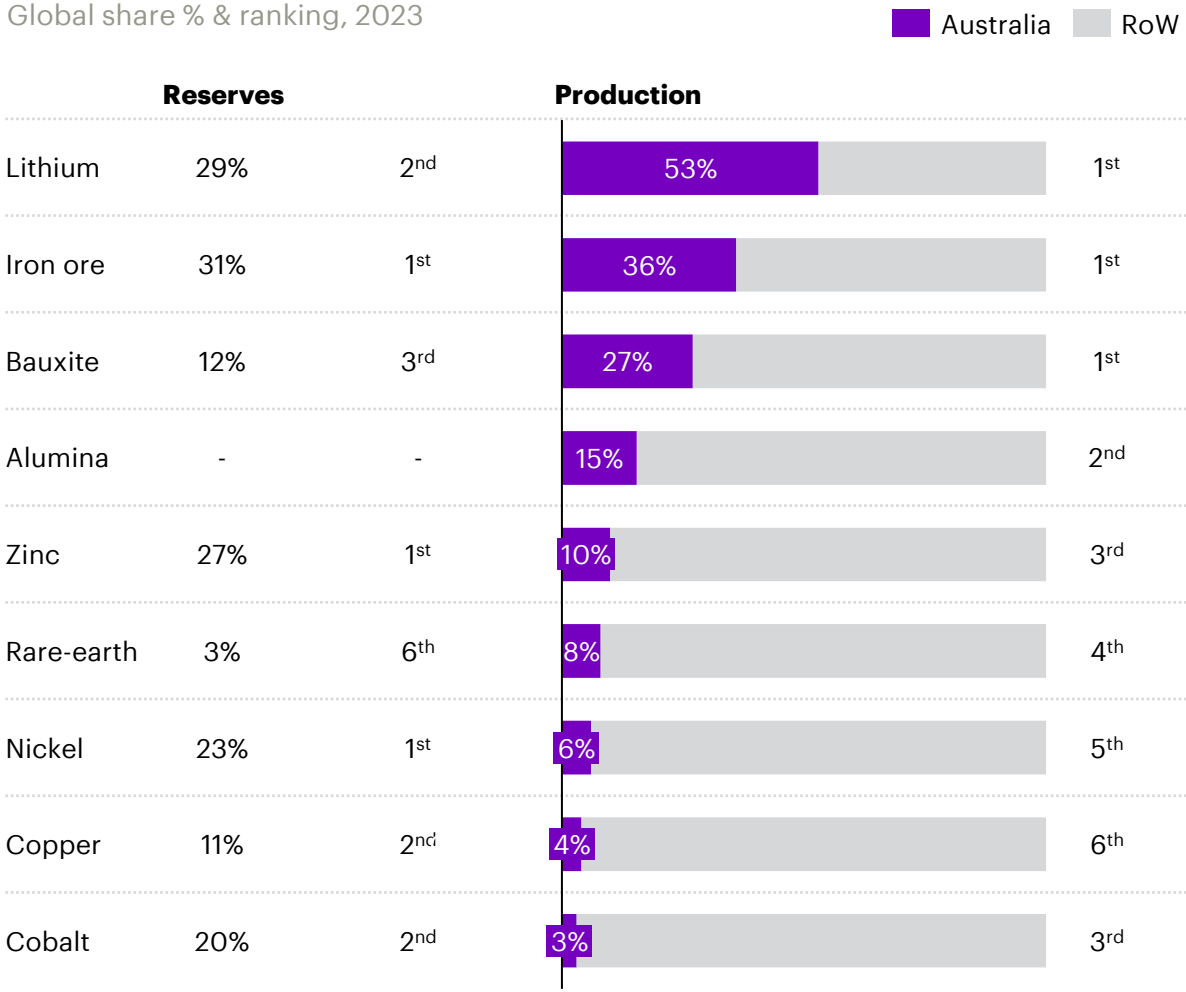
Proximity to key demand for batteries, iron ore and green hydrogen

Estimated % of global demand



Australia's market share of global production and resources

Global share % & ranking, 2023

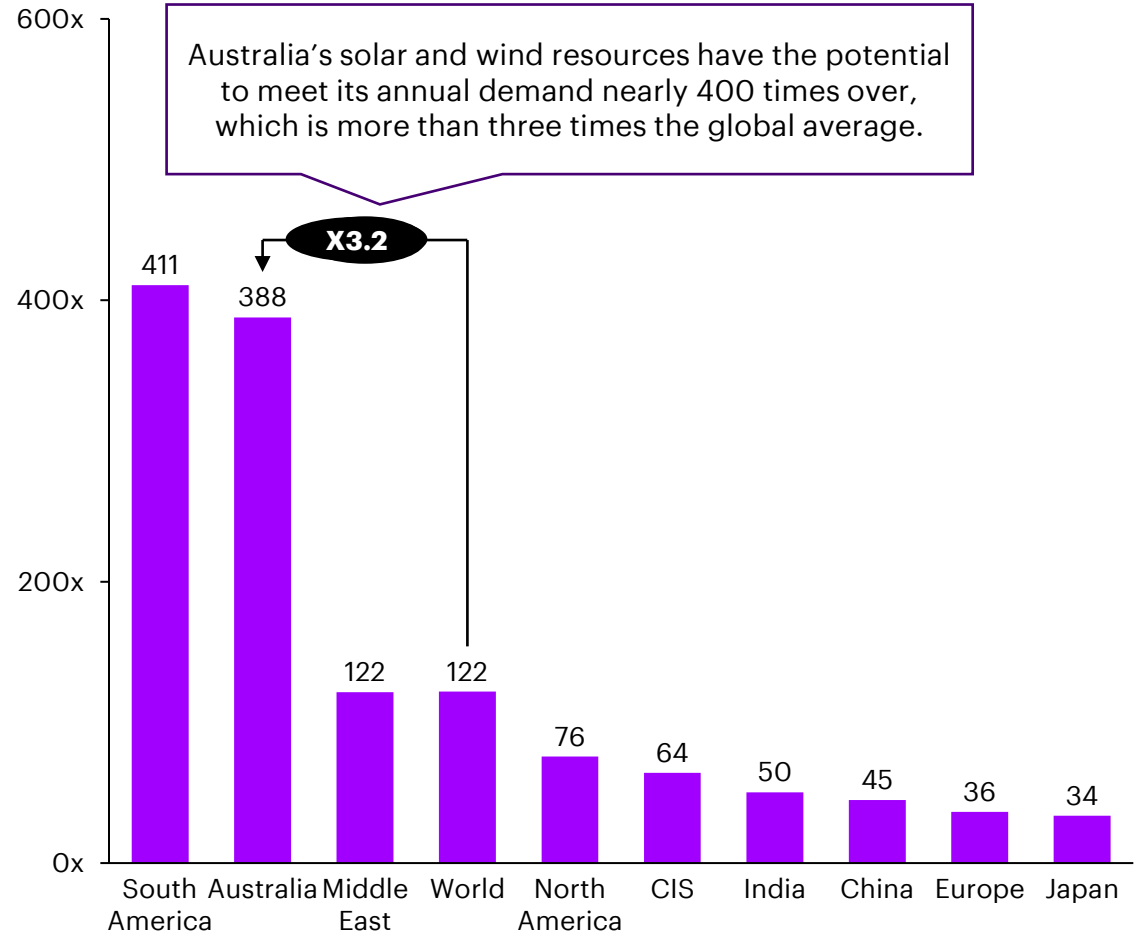


Notes: Demand estimates are based on 2030 forecasts for hydrogen and batteries, as these industries are less established than critical minerals and iron ore and are therefore expected to see greater changes in demand between now and 2030. 1. Critical mineral demand is based on lithium consumption, which is Australia's largest critical mineral export. India is based on share of lithium carbonate imports in 2021. 2. Iron ore demand is based on iron imports for 2022, 3. Share of hydrogen demand is based on government announcements and the hydrogen and derivatives forecasted for 2030 under the IEA's Stated Policies Scenario. 4. Battery demand is based on lithium ion cell demand by 2030. Demand outside of China, US and Europe is 20%. Sources: Geoscience Australia (2022), Statista ((2020, 2021, 2022), IEA (2023), Reuters (2023), Centre for Strategic and International Studies (2022), CSIRO (2023, 2023), South Asia Regional Energy Partnership (2023), OEC (2022), McKinsey and Company (2023)

Further, Australia has one of the highest potentials for renewables in the world; renewable output could meet its energy demand 400x over, using only 0.1% of total land mass

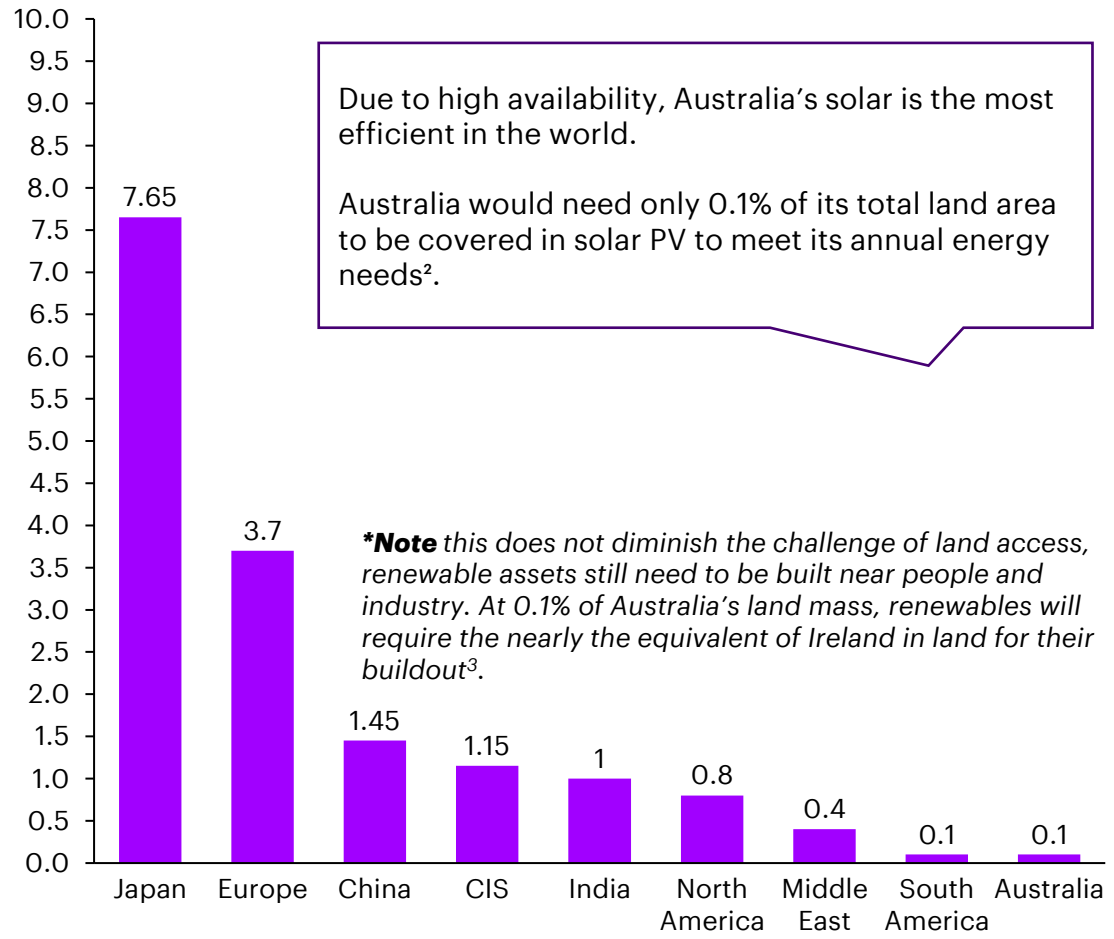
Solar and wind potential as multiple of total energy demand[1]

Index, 2021



Share of land needed to theoretically produce all energy from solar[1]

% of land required for solar out of country's total land[2], 2021



Note: 1. Excludes Africa. Sources: Carbon Tracker Initiative (2021) 2. Note that high penetration of solar alone would not practically support a country's energy needs as storage considerations are needed to overcome intermittency. 3. 0.1% of Australia's 7.68 million km² landmass is 76,800 km². Republic of Ireland is 72,000km² Source: Adapted from Peacock, B (2021), Geoscience Australia (2023)

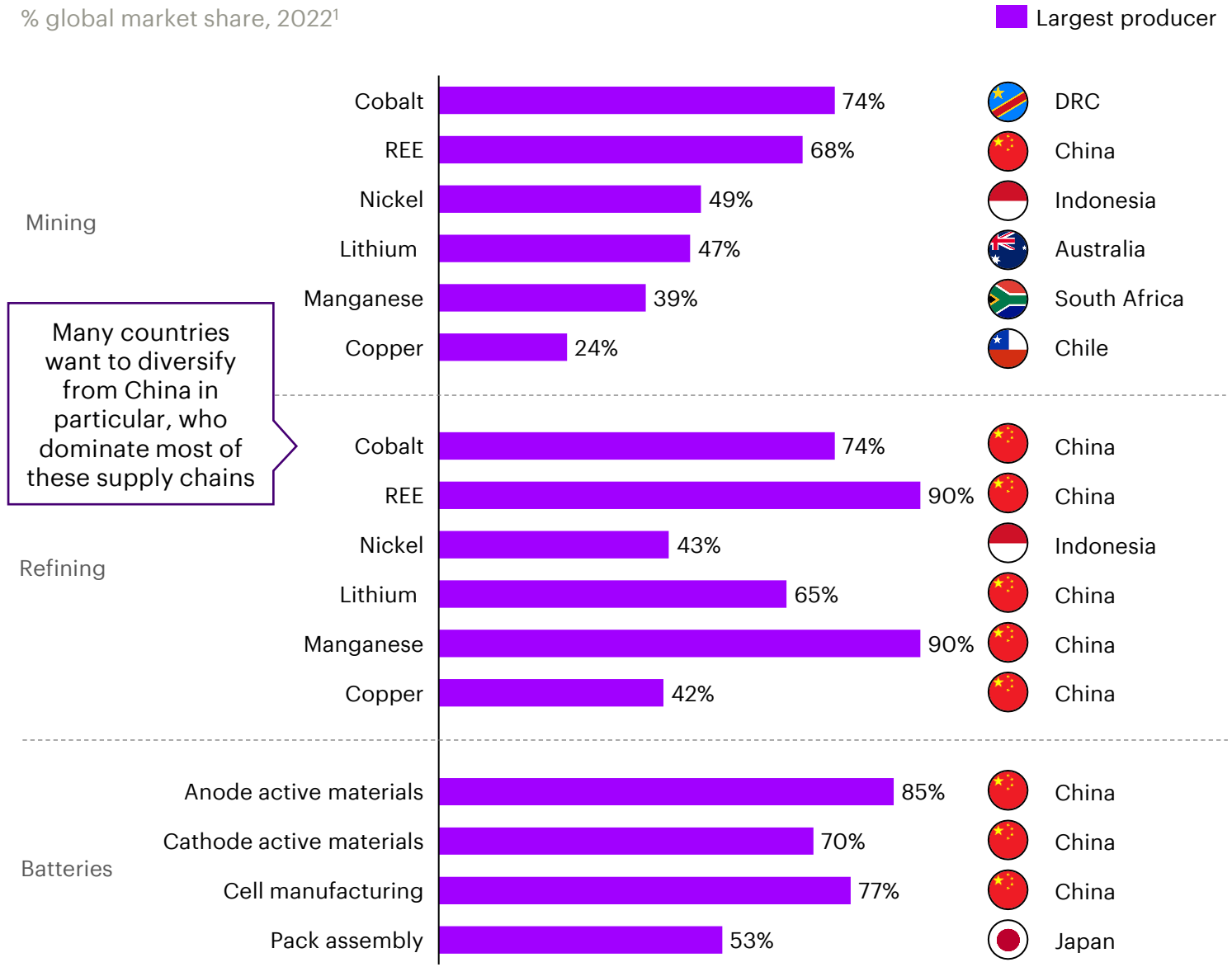
Australia can also benefit from the desire to diversify global supply chains, which are currently concentrated in a few countries

The production and export of clean energy materials and technologies is concentrated to a few countries. This is especially prevalent in value adding critical minerals refining, battery active materials and manufacturing, which is mostly dominated by China.

Geographical concentration at any point increases the vulnerability of the entire supply chain to disruptions caused by trade restrictions, natural disasters, technical failures or company decisions. This has already been demonstrated by the shutdown of industries during COVID-19 and war in Ukraine, which contributed to record high prices of many critical minerals and batteries in 2022.

Global businesses and governments are therefore seeking ways to diversify their supply chain operations as part of their resilience strategies. As they seek new partnerships, Australian exporters have an opportunity to tap into these new markets and expand their customer base.

Supply-chains in value-adding critical minerals and batteries are heavily concentrated

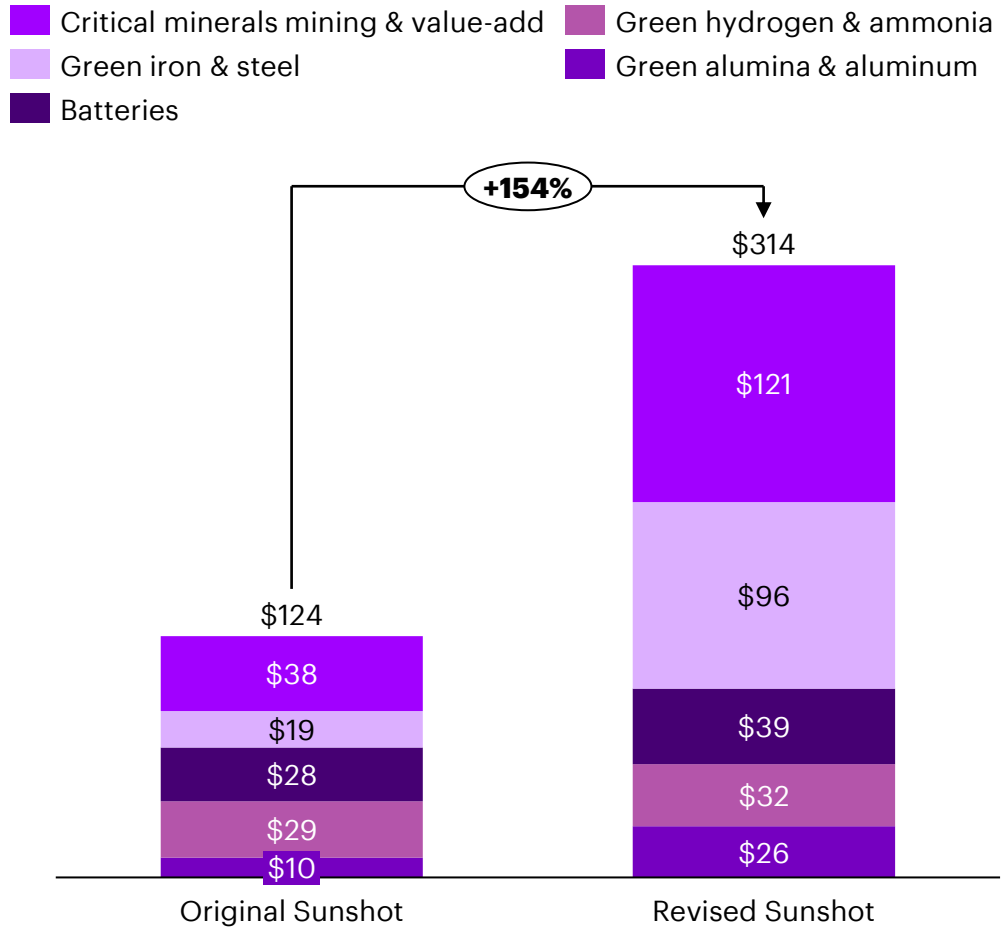


Notes: 1. Manganese mining, cathode and anode active material values are from 2021, while pack assembly is from 2017. Sources: IEA (2023), Statista (2022), S&P Global Market Intelligence (2023), IEA (2022), BloombergNEF (2023), AusTrade (2018)

The opportunity for clean energy exports has increased from $124B to $314B p.a. by 2040, considering the changing market and opportunity for Australia

The opportunity has increased to $314b by 2040 in a high ambition scenario

Billions AUD per annum, 2040



This is due to the increasing pace of the global energy transition

	Changing state of the market
Critical minerals[1]	Critical mineral prices have drastically increased as supply struggled to meet the rising demand for clean energy technologies. For example, the lithium price has risen ~4x since 2021. Furthermore, there has been increased investments from importers looking to diversify their supply-chains for national strategic interest (i.e. de-risk supply-chain concentration) which has created a price premium for some supply sources.
Green iron & steel[2]	The opportunity for green pellets and green iron has increased, due to the increasing demand to decarbonise steel globally and technical developments enabling increased supply (especially with magnetite ore). There has been increased investment from iron ore miners into green iron R&D and movements downstream look likely. There is also evidence of international steel producers (e.g. Baowu, POSCO) becoming more active in the Pilbara.
Batteries[3]	Demand for batteries has grown 64% since 2021, driving 35% higher prices reflective of the surging global EV trend (+60% in 2022, +30% to 14m EVs globally in 2023). A nascent Australian industry supply chain is developing, and government has already indicated support in the space. Potential demand from stationary storage in Asia and heavy domestic vehicles are driving a higher opportunity.
Green hydrogen & ammonia[4]	Several key trading partners have set high hydrogen import targets including; Japan, South Korea and Europe. Government support has increased. In particular, the Hydrogen Headstart program will kickstart the industry with a handful of large-scale projects. This, along with considerations of higher forecasts in AEMO's ISP has led to a slight revision upwards from 2021.
Green aluminium[5]	The opportunity from green aluminium has increased. This is due to the increasing pace of decarbonisation in the global aluminium industry and Australia being well placed to produce competitive aluminium once renewable energy and storage has been rolled out at scale. The high ambition target assumes this to be the case.

Notes: 1. Critical minerals includes mining and value-add for lithium, copper, nickel, cobalt, REE and manganese and were selected based on Australia's high material EDR reserves or share of current production, moderate export value projection and where the mineral is critical to clean energy technologies. 2. Green iron includes DRI. 3. Batteries includes active materials, cell manufacturing and battery pack assembly only, as upstream is captured in critical minerals. 4. Assumes green H2 is transported via ammonia and as such also includes the market for green ammonia. 5. Green aluminium includes alumina. Sources: See appendix for full source list and methodology, Accenture analysis

Critical minerals could reach $121b p.a. by 2040 driven by increasing the amount of value-adding done onshore

Australia could unlock a $121b critical mineral export opportunity by 2040 with stronger policy support. This is almost double (91%) the expected opportunity under a low ambition scenario of $64b.

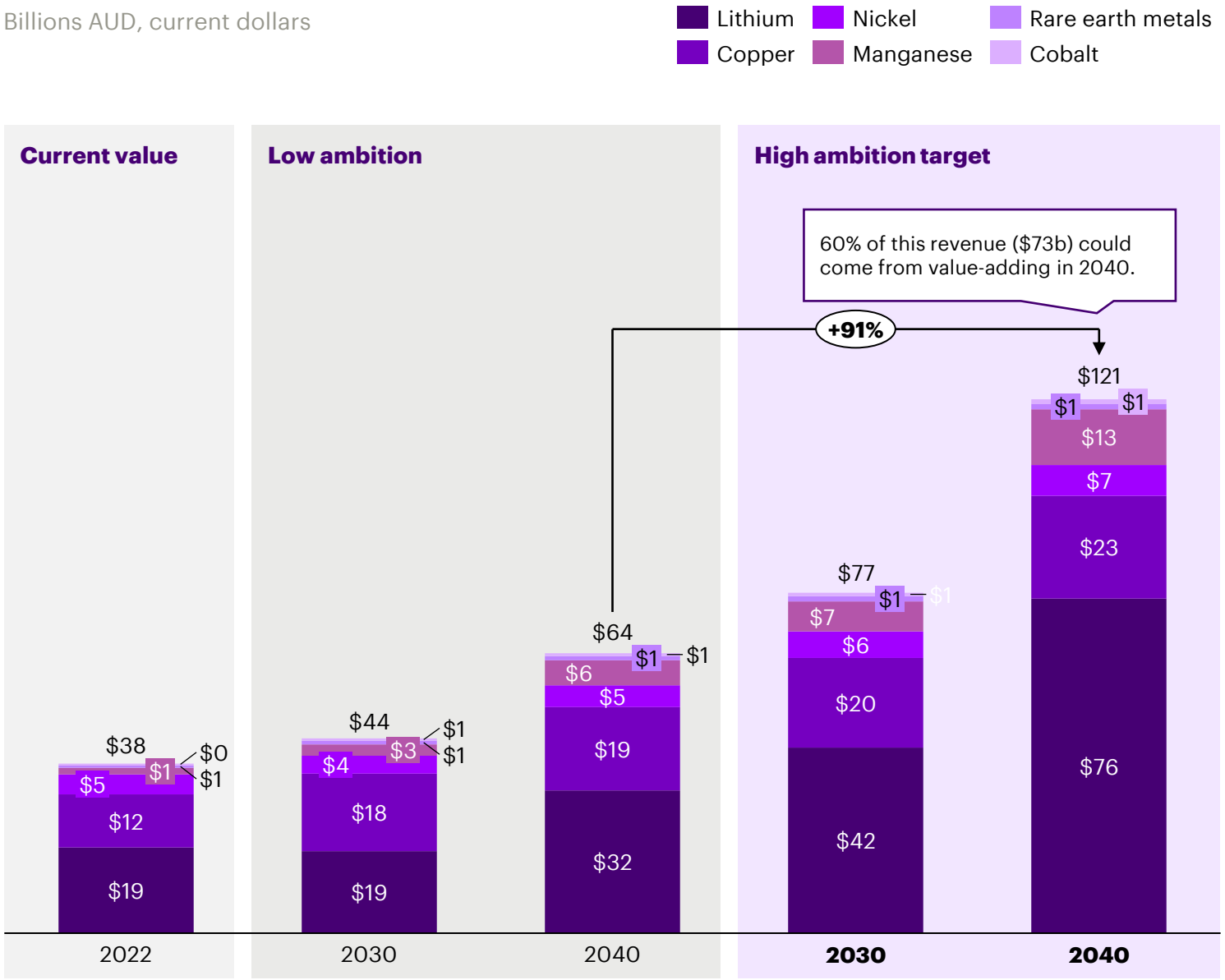
Australia has a historical advantage in mining, due to our abundance of mineral reserves and highly skilled mining workforce. However, Australia must increase onshore refinement to unlock the full opportunity.

$73b (~60%) of critical minerals revenue could come from value-adding (i.e. refining) in a high ambition scenario by 2040.While refining is currently dominated by China, global supply is expected to fall short of demand as countries increase decarbonisation targets. Many countries are also looking to reduce their dependency on China through policies such as the US Inflation Reduction Act, which the US has already extended to Australia with the AUS-US Climate, Critical Minerals and Clean Energy Transformation Compact. Australia has made strong progress on lithium hydroxide, rare earth and nickel sulphate refining since 2021, this must increase to meet high ambition targets.

Notes: See full notes and assumptions in appendix. Lithium value decreases in 2030 low ambition due to a projected decline in record high spodumene & lithium hydroxide prices. 2030 and 2040 estimates assume prices stabalise after DISR 2028 commodity price forecasts, and an exchange rate of 0.67 USD/AUD. Source: IEA (2023), DISR (March 2023, June 2023), Geoscience Australia (2022), Prime Minister of Australia (2023), Accenture analysis

Critical mineral export revenue

Billions AUD, current dollars



Green iron & steel could reach $96b p.a by 2040 driven by value-adding iron ore to capture increased green iron demand globally

While the global steel industry is considered a "hard-to-abate" sector, growing demand indicators for green steel have mobilised producers to act. Inclusion of steel in Europe's Carbon-Border Adjustment Mechanism (CBAM) has catalysed key steel producing countries such as China, Japan and Korea to explore decarbonisation pathways.

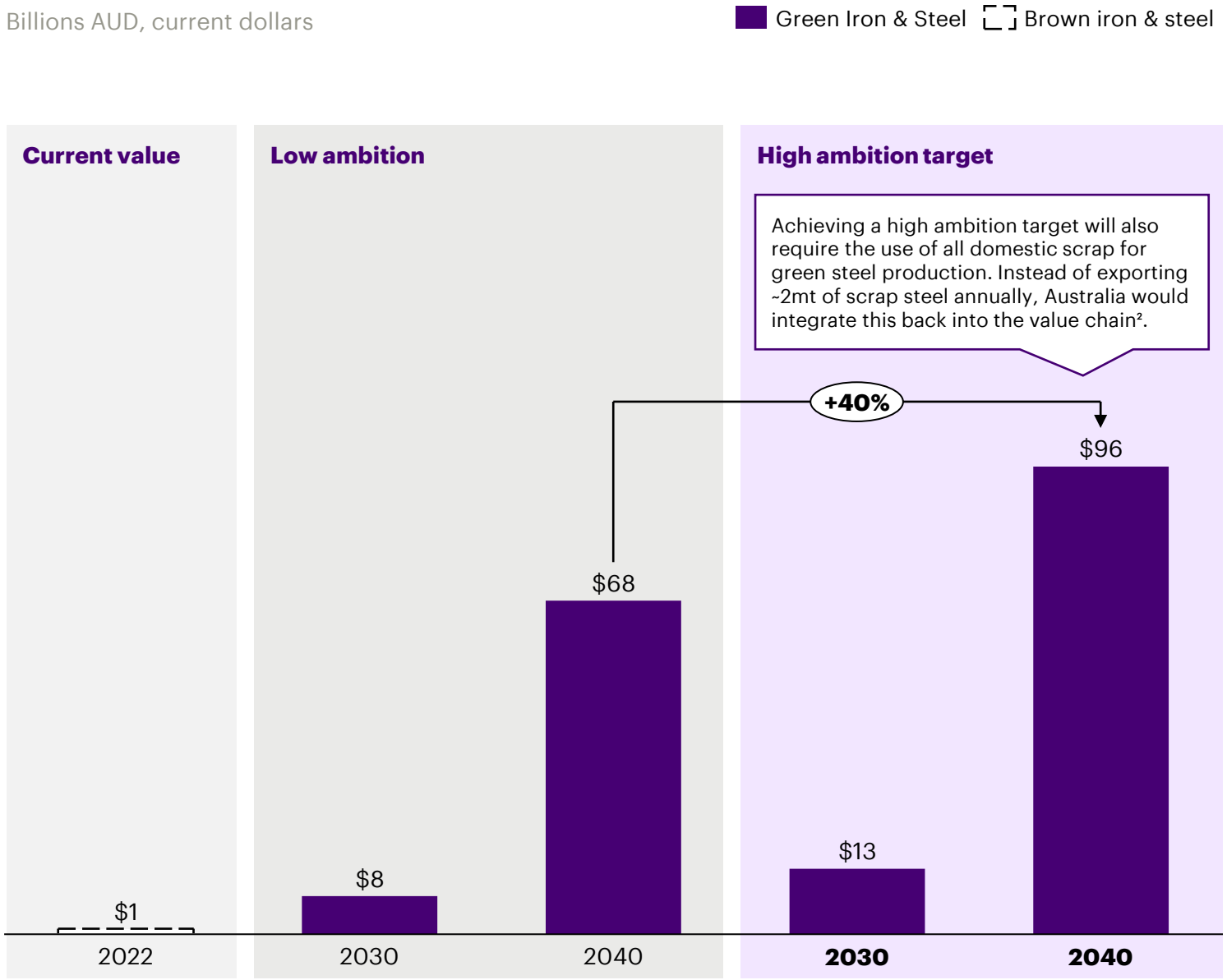
The role of green iron is expected to grow rapidly, reaching over 700mt and accounting for more than 39% of primary steel production by 2040[1]. With policy support, Australia can capitalise on its global leading iron ore industry to produce green pellets and green iron, developing a 268mt p.a. green iron market by 2040. Combined with increased downstream capacity to grow steel exports from 1mt today to 20mt, combined revenue can reach $96b.

Producers are already increasingly investigating this opportunity in Australia, evidenced by new technologies and projects funded by both domestic and international producers. Availability of green hydrogen at scale will also enable our own steel industry to decarbonise.

Notes: 1. This would require rapid technology uptake and capacity growth, in line with Mission Possible Partnership's Technology Moratorium scenario. Noting that projected proportion of green steel production using green iron varies up to 88% across different forecasts, such as McKinsey and Agora. 2. Scrap steel imports has not been considered as recycling remains highly localised due to logistical costs and countries increasingly look to ban exports of scrap for their own secondary use (e.g. UK and Europe). See full notes and assumptions in appendix.
Sources: Burke et al (2022), IEA (n.d., n.d.), Venkataraman et al (2022), Mission Possible (2022), Agora (2021), McKinsey and Company (2022), Accenture Analysis

Green iron and steel export revenue

Billions AUD, current dollars



Battery revenue could reach $39b p.a by 2040 building capability across active materials, cell and battery pack manufacturing

While Australia currently accounts for <1% of global active materials and battery manufacturing, new firms are looking to capitalise on surging global demand. With strong policy, Australia could accelerate this growth.

Australia produces ~50% of global battery raw materials which would support battery companies across the value-chain. Australia also has an underutilised skilled manufacturing workforce, after car manufacturing moved offshore in 2017.

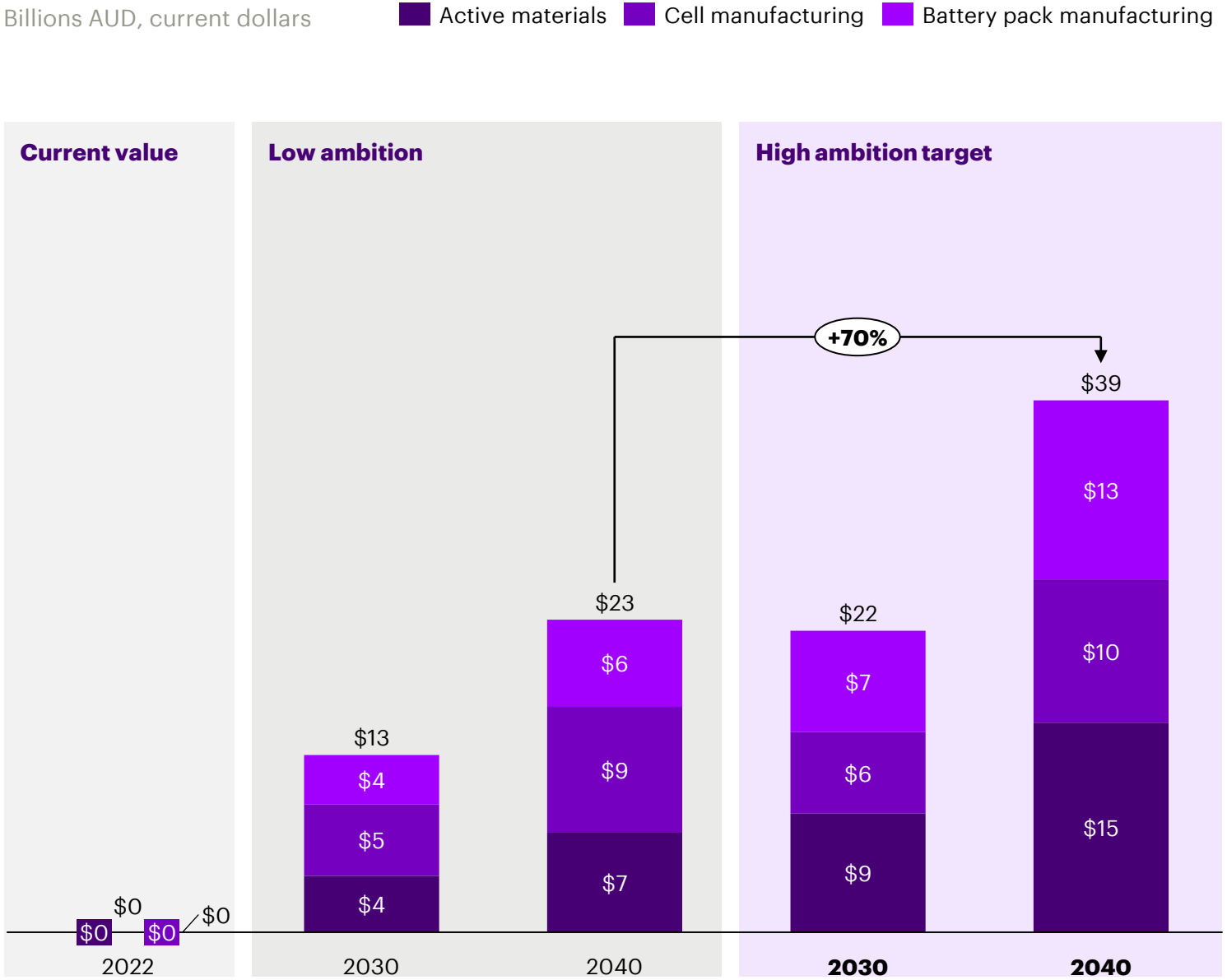
There are multiple opportunities to stimulate domestic demand, especially in the defence industry and heavy haulage. For example, electrification of haulage in mining would increase domestic demand by 400MWh in 2030, whilst reducing diesel fuel imports by $10b p.a[1].

Policies such as the UK National Security and Investment Act (2021), which has blocked 3 Chinese tech investments, show an increasing desire to diversify supply chains. Australian batteries could also benefit from this.

Notes: See full notes and assumptions in appendix. Estimates for 2030 are based on Accenture's battery global supply chain modelling under low and high aspiration scenarios. 2040 forecasts are based on the increase in battery demand under BNEF Economic Transition Scenario from 2030 to 2040. Estimates are based on an exchange rate of 0.67 USD/AUD. 1. stakeholder consultation with Climate Energy Finance. Source: IEA (2023), DISR (March 2023, June 2023), Geoscience Australia (2022), Prime Minister of Australia (2023), Accenture (2023), Climate Energy Finance, Accenture analysis

Battery active materials and manufacturing export revenue

Billions AUD, current dollars



Hydrogen and ammonia could reach $32b p.a by 2040 driven by proximity and trade relationships with key importers

Global hydrogen demand is expected to rise 1.5x from 2022 to 2030, with 30% of demand coming from new applications. Apart from establishing green hydrogen consumption targets, many countries have also put forward policies to accelerate the development of technology and a global supply chain, such as the US's Inflation Reduction Act (IRA), Europe's IPCEI Hy2Use and Hy2Tech as well as Japan's Green Innovation Fund.

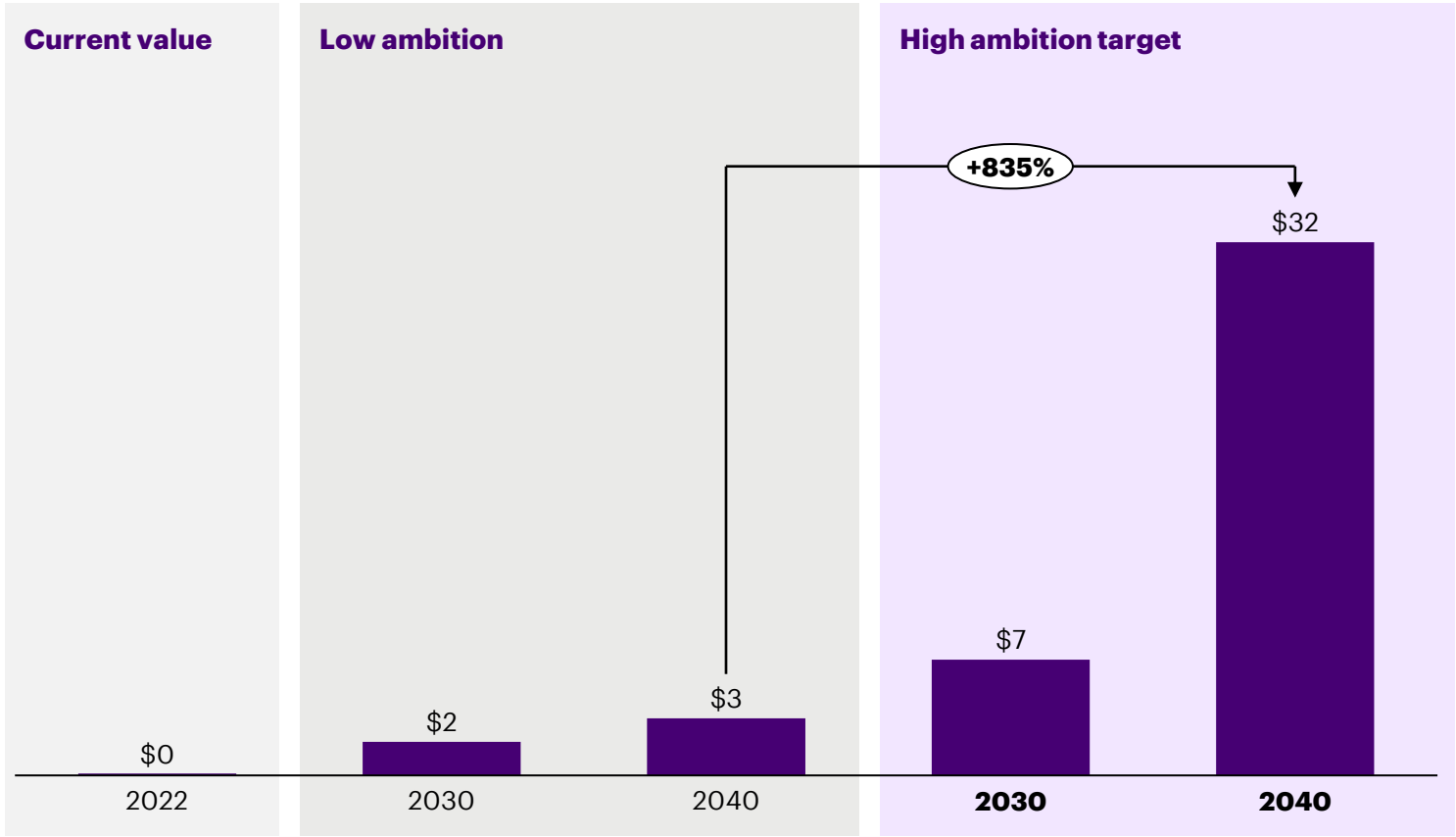
As a leading exporter of coal and liquified natural gas (LNG), Australia is well placed to transform its role as an energy exporter in a decarbonised world through green hydrogen. Assuming low levelised cost of electricity (LCOE) for renewables and proximity to key importers, Australia could be a low-cost producer of green hydrogen helping to decarbonise hard-to-abate sectors. Australia can leverage existing trade relations with key sources of demand as well as existing capabilities and infrastructure, such as from the LNG terminals for ammonia.

Stronger policy support could unlock a $31.8b green hydrogen opportunity by 2040. This would propel Australia more than halfway to replicating its leading LNG market share at a green hydrogen revenue of $55.4b and enable other industries to decarbonise, such as steel.

Notes: See full notes and assumptions in appendix. Sources: Burke et al (2022), IEA (n.d.), Accenture analysis

Green hydrogen and ammonia export revenue

Billions AUD, current dollars



Green hydrogen is also a key enabler of the green iron & steel opportunity

An at-scale hydrogen export industry will support lower-cost hydrogen for green iron and steel. Hydrogen is needed at prices of ~$1/kg to displace LNG in green iron production processes, which will only be achieved through economies of scale. The green iron and steel opportunity will create a domestic demand of ~2.7mt of hydrogen in 2030 and 20mt by 2040 in addition to export quantities if high ambition targets are met.

Green alumina and aluminum could reach $26b p.a by 2040 if firmed renewables are available at scale

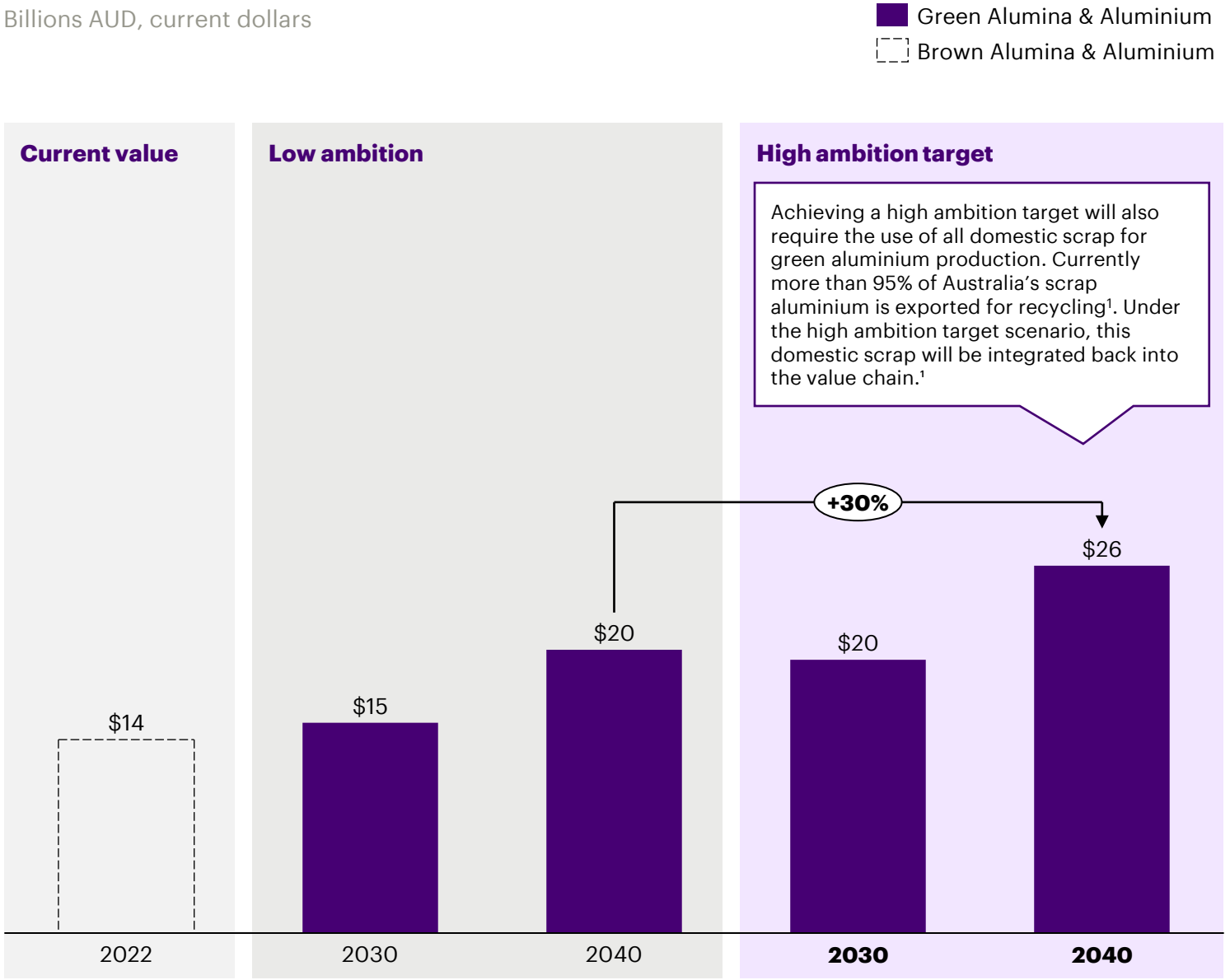
Global demand for alumina and aluminium is projected to rise given that aluminium is an important input to several technologies critical to the energy transition. In tandem, there is a growing preference for green aluminium, evidenced by emerging policies such as the European Union's Carbon Border Adjustment Mechanism (CBAM) which will impose a price on high-embodied carbon aluminium entering the EU.

As a global leader in bauxite exports, Australia can help decarbonise the global aluminium supply chain through increased value-add on-shore. Australia's abundance of wind and solar resources makes it well placed not only to decarbonise aluminium smelting, but also to adopt emerging electrification technologies in alumina refining, many of which are being developed in Australia.

However, policy support is needed to ensure Australia's evolving energy system can effectively tap into Australia's abundant renewable resources to provide a reliable, low-cost supply of electricity to alumina and aluminium producers. This would enable Australia to unlock $26Bn in export revenue by 2040 through increased alumina refinement and aluminium smelting on-shore.

Green alumina and aluminium export revenue

Billions AUD, current dollars



Notes: 1. this was 118kt in 2020, see full notes and assumptions in appendix. Sources: Burke et al (2022), IEA (n.d.), Australian Aluminium Council (2021), Accenture analysis

Circularity and material recovery are essential to ensuring the high ambition targets are sustainable long-term, 4 principles should be considered throughout material lifecycles

1. Sustainable planning and design[1]

- Projects should plan for shared use infrastructure in co-located industrial clusters – this can reduce the amount of resources required to build clean industry projects.
- This can also reduce the overall renewable energy buildout requirement, lowering costs and reducing the risk of environmental impacts from higher than required buildout.
- All projects should be assessed through rigorous and independent environmental impact assessments and approval processes – working with communities in early stage planning to develop the right types of projects in the right places to deliver benefits to communities and nature.

2. Sustainable extraction and manufacturing[2]

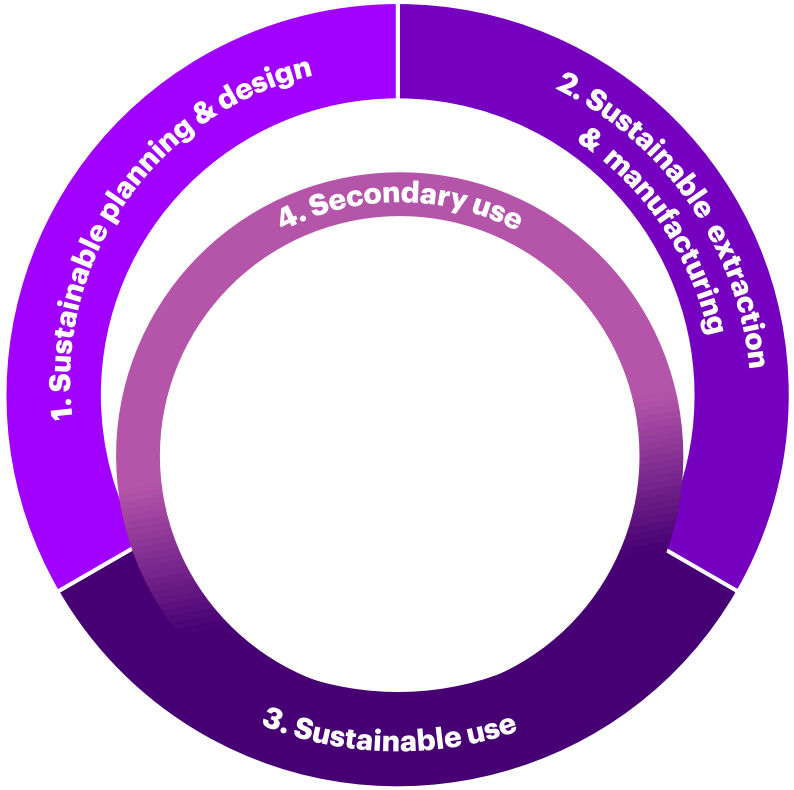
- Electrification of all feasible equipment and vehicles is required across mining and manufacturing.
- For hard-to-abate processes such as steel production, hydrogen will be required. This may be used in some heavy haulage vehicles. All hydrogen use should be carbon-free.
- Energy efficiency should be a key focus throughout production to also reduce the required renewable energy buildout and lower costs.
- Sustainable mining practices that avoids or minimises waste and water use should be implemented.
- Rigorous implementation of the mitigation hierarchy (avoid, reduce, restore) across all opportunities is fundamental.

3. Sustainable use

- Circular economy strategies should consider efficiency in use through investment into lifetime extension strategies and shared use of clean energy technologies, this is however outside of the scope of producers within the clean export industries.

4. Secondary use[3]

- Secondary steel, aluminium and battery markets will become increasingly important (40% of steel and 50% of aluminium demand could come from secondary sources by 2050, battery material waste is expected to grow 8x between 2030-40 to 235kt globally).
- For Australia to build its recycling capabilities, coordinated industry development is needed to increase commercial viability and co-locate sources of scrap with primary production. This can be done through recycling partnerships across the value chain as part of industrial clusters.
- Material recovery in waste streams (e.g. tailings dams) is also an opportunity in critical minerals.



Notes: 1. investment in industrial clustering is considered in section 3. 2. the renewable capacity and electrification requirement for the five clean exports industry must be a key consideration of wider clean energy policy. 3. Use of Australia's secondary steel and alumnium is considered in high ambition targets, however imports of scrap has not been considered as recycling remains highly localised due to logistical costs and countries increasingly look to ban exports of scrap, for their own secondary use (e.g. UK and Europe). Sources: Mission Possible Partnership (2022, 2023), World Steel (2021), University of New South Wales (n.d.), Australian Technology Network of Universities (n.d.), Peng et al (n.d.), Deloitte (n.d.), CleanAction coalition (2023),

Contents

However, the window of opportunity is closing fast as other countries invest heavily into clean industries and capture private investment

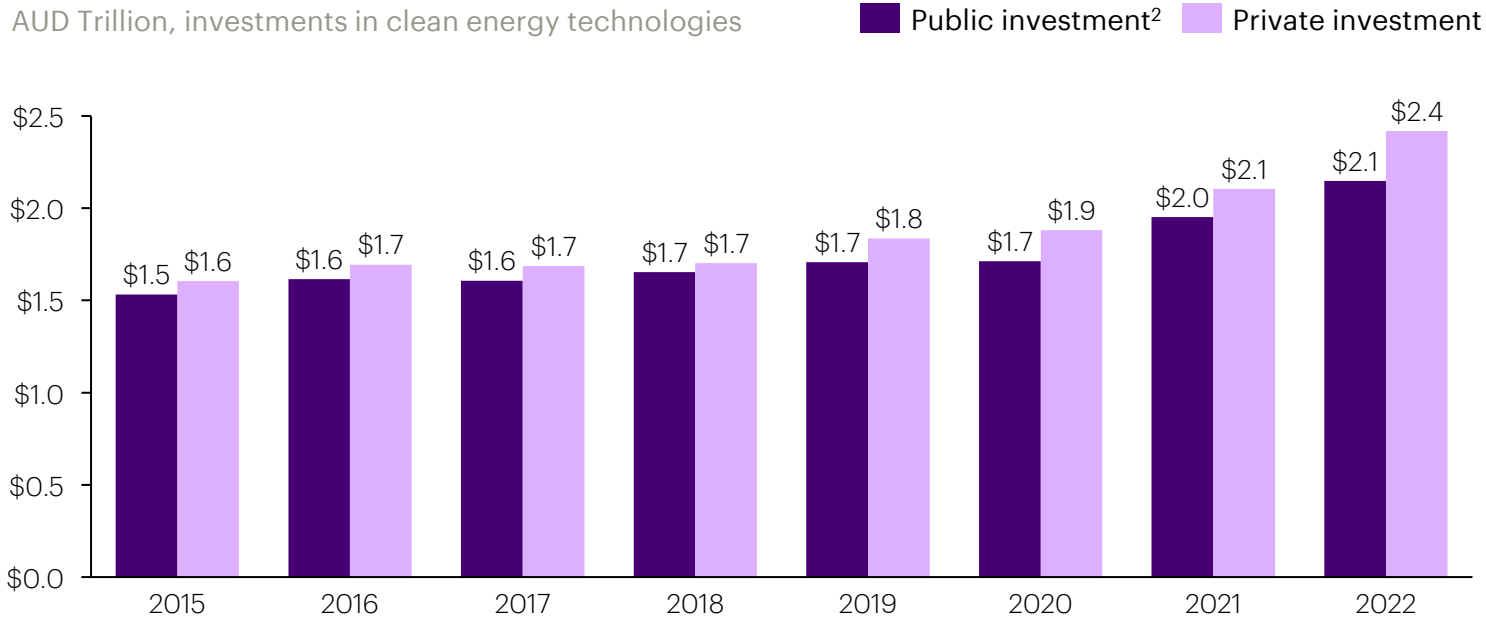
There is a global race for the private capital to build sovereign capability in clean energy industries. Governments around the world are making investments into clean energy technologies and their manufacturing.

Increased public investment is catalysing private investment; over $400b of private clean investments have been announced in the U.S, in the year since the IRA's passage[1]. China has been a leader in incentivising private investment - $815b was spent on clean technologies there last year.

Australia is at risk of losing private capital offshore as private capital increasingly looks to make investments in regions where it will be supported by baseline public investments.

Notes: All figures are $AUD unless otherwise stated, 1. Based on announcements tracked by American Clean Power, 2. As reported in IEA Government Energy Spending Tracker, 3. In addition to the IRA, the U.S Infrastructure Investment and Jobs Act (IIJA) and CHIPs act make additional investments in clean energy and clean energy adjacent industries, 4. Due to the large expected uptake of clean energy technologies and the uncapped nature of US credits, estimated spend is higher than CBO estimates of US$380b.
Source: Whitehouse (2022, 2023), Credit Suisse (2023), Joyce, C. & Stanford, J. (2023), BloombergNEF (2023), EU Commission (2022), Government of Canada (2023), American Clean Power (2023), IEA (2023, 2023), Accenture analysis

Public investment in clean energy is increasing; catalysing even higher rates of private investment



Example investments

U.S IRA[3]	• The US is spending $1.2t over 10 years (~$120b p.a) on clean electricity, manufacturing of clean technologies, transport, clean fuels, CCUS, electrification and climate readiness.[4] • This is set to increase private investments from the ~$210b already invested in 2022, with over $400b of new private investments announced since passage of the IRA[1].
China	• China has had successive industrial policies to develop dominant positions in the manufacturing of many clean technologies. • Policies have catalysed world-leading private investments – over $815b in 2022 - helping to build a clean tech manufacturing capacity 8-10x greater than North America and Europe combined.
Made-in-Canada	• Canada is spending $94b over 10 years across clean electricity, manufacturing of clean technologies (incl. critical minerals), hydrogen and CCUS. • Large private investment decisions are being spurred on, with Volkswagon investing in a $154m gigafactory development in light of battery manufacturing tax credits.

Countries are investing in clean industries for strategic reasons; economics, decarbonisation at pace and geopolitics

Many governments are making direct strategic investments into clean energy, with the intent of creating the policy signals and settings that will drive the required private investments into clean energy, for three strategic reasons:

- To capture the economic opportunity,
- decarbonise to avoid loss of habitats, life and economic value and,
- guard energy security against geopolitical risk.

Without a clear roadmap and the confidence to invest market forces alone may not be able to deliver these outcomes[1]. Governments around the world are now making significant public investments to develop clean industries at a pace aligned with emissions targets, and to provide private sector investment with the confidence and direction to drive towards that goal. A new paradigm is emerging of strategically focussed public investment working in complementarity with the critical role of the private sector.

Notes: 1. this has also been difficult without an accurate global price on carbon. 2. expected to increase to over 38 million by 2030. 3. As noted by the IPCC. The transition from fossil fuel-based economies and exports to clean energy, globally, will be required to achieve this. Sources: BloombergNEF (2023), Oxford Economics (2023), Rodrik, D. (2014), Juhász, R., Lane, N. & Rodrik, D. (2023) UN Environment (2017), Flegal, J (2023), World Economic Forum (2023), Swiss RE (2021),IPCC (2023), Accenture analysis

Clean industry policy is strategically important for nation states due to three reasons

1

Economic & job opportunity

- There was over US$1 trillion in private investment in clean energy in 2022.
- This is adding economic value to countries, creating jobs and expanding tax bases; Oxford Economics estimates over US$10 trillion in value-added to the global economy from clean energy technologies in 2050 and there's already over 12million people working in renewable energy today[2]
- This is occurring in tandem with the decline of fossil-fuel industries, which if not replaced, will result in a decline in economic value and jobs – investment in clean technologies is now higher than that of fossil fuels.
- Clean industry policy is increasingly viewed as an investment to increase prosperity and necessary to avoid net losses in economic value and jobs.

2

Decarbonise at speed & scale

- Scientific consensus shows that to avoid the most devasting effects of climate change, the globe needs to decarbonise on a below 1.5 degrees trajectory[3]
- The environmental loss and danger to human health and wellbeing is added to by the economic costs associated with not addressing climate change; which could shrink global economic value by 5-10% by 2050.
- Effects of this are already being felt today; weather related disruptions in 2021 caused US$233b in costs to the global economy (0.24% of global GDP).
- Decarbonisation at the speed required cannot be done through markets that don't factor in the externality cost of carbon.
- Investment and capability needs to be directed towards clean energy to avoid these effects and costs.

3

Geopolitical risk factors

- Energy is integral to our societies and way of life, the ability to produce and/or obtain it is of national significant importance.
- As the world transitions to clean energy, the materials and capabilities required to build and run these technologies has also become nationally significant.
- With many of the supply-chains for clean energy technologies highly concentrated, countries are increasingly seeing the need to directly establish sovereign capability as a hedge against geopolitical risk, or to 'friend-shore' these capabilities with key international partners.
- The significance of this is growing with the advent of the internet of things and connected devices, increasing the potential for connected clean technologies, such as batteries, to be interfered with by malevolent actors.

These investments align with a broader global trend towards sovereign capabilities and more selective trade

Australia is now competing in a landscape that has shifted from a paradigm of free trade to one of increasingly selective trade with a smaller group of partners. Global trade has declined over the past decade, led by tensions between the two largest economies. Trade as a proportion of gross world product declined from 60% in 2011 to 57% in 2021. The US and China, have led the decline. Between 2015 and 2020, US imports as a percentage of GDP fell by 1.1 percentage points. Over the same period, China's imports as a percentage of GDP fell by 0.5 percentage points.

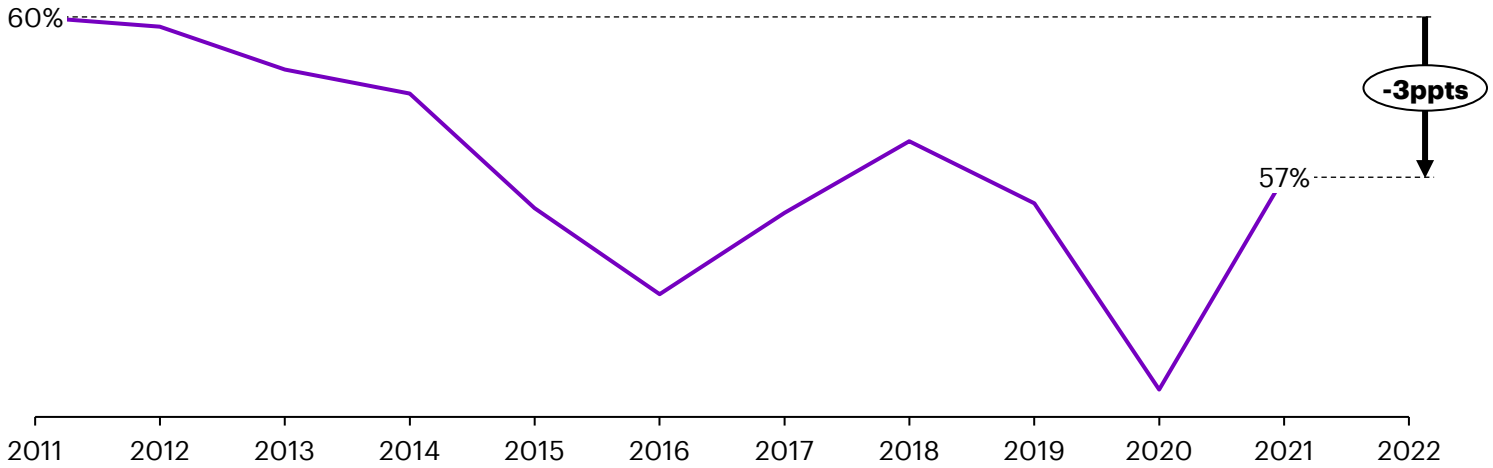
Since 2011, the number of global trade and investment barriers imposed increased tenfold. This includes measures like export controls and tariffs. In 2021, 76% of national investment policy measures in advanced economies restricted foreign investment.[1]

The shift towards economic nationalism will make it harder for Australia's clean exports to compete without strategic support that considers this new paradigm. However, with strategic support, Australia could benefit from some selective trade[2].

Notes: 1. 'Advanced economies' refers to Europe, North America and 'other developed countries' as per IMF. 2. see examples of friend-shoring in on next page. Sources: International Monetary Fund (2023); UN Conference on Trade and Development (2022); Peterson Institute for International Economics (2022); World Bank (2021); Accenture analysis.

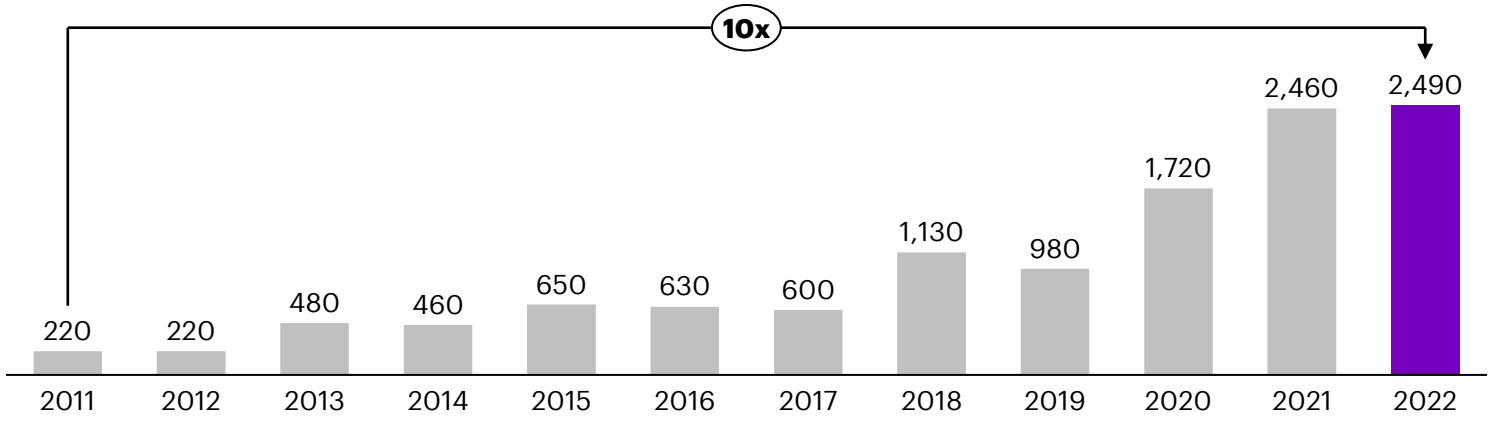
Global trade has declined by 3ppts since 2011

Trade as a % of gross world product



Global trade and investment barriers have increased tenfold since 2011

Estimated number of barriers imposed



Supporting this trend, international clean policy has been focused on domestic content and creation of 'friend-shored' trading blocs

Countries are increasingly incentivising domestic content through their clean energy policies. This could pose potential risks for Australian clean industries with less international demand.

However, there is also an opportunity from countries who are looking to 'friend-shore', by providing access or incentives in their clean energy policies for their key trading partners.

This is especially for the components which countries do not naturally have access to, like critical minerals. However, it is also increasingly being used to fill the gap in sources of supply as countries (particularly the U.S and Europe), limit their imports from China.

As China has been the dominant manufacturer of many clean energy technologies, their exclusion from some of these new trading blocs creates a large opportunity for countries such as Australia. If support is available for Australian clean industry, it can rapidly scale and fill the global supply gap.

Notes: 1. Note this does not constitute a 'watering-down' of any permitting processes but put strategic clean tech manufacturers to the front of the queue, 2. Note the DRC, Zimbabwe, Namibia, Chile and Mexico are all increasing domestic reservation requirements in their critical minerals Source: Whitehouse (2022), Joyce, C. & Stanford, J. (2023), EU Commission (2022), Hook, L. et al. (2023), Accenture analysis

Countries incentivising domestic content in clean energy policy and creating selective trading blocs

United States

IRA – Renewable electricity production & investment tax credits: Projects receive a 10% bonus on the tax credit if all iron & steel used has been manufactured in the U.S and 40% of the value of all other manufactured products used in the facility/project (including raw materials) has come from the U.S (rising to 55% after 2026).

IRA - Clean vehicle tax credit: purchasers receive $3750 per EV if 40% of the critical minerals in the battery were extracted or processed in the U.S (rising to 80% after 2026), and/or another $3750 if 50% of the manufactured materials were manufactured in the U.S (rising to 100% after 2028).

China

Successive 5 Year plans: China has provided direct subsidies to Chinese producers across the full value-chain of clean technologies, rather than just focussing on the final product itself. This has created the same effect, at an even larger scale, as domestic content incentives. U.S and European policies are in part a reaction to China's dominance in domestic content.

Made in China 2025 Policy: Industrial policy to increase domestic content of core materials across manufacturing, including clean technologies to 70% by 2025.

Europe

EU Net-Zero Industry Act: stipulates that 40% target of clean technologies must be made in Europe by 2030 and are creating 'strategic' permitting categories to prioritise planning and permitting approvals for plants manufacturing these technologies[1].

Indonesia

Domestic reservation and export bans on Nickel[2]: Indonesia plans to grow its domestic value-added capabilities in refining and cathode production of the battery value-chain by retaining nickel domestically, of which it has 22% of global reserves. It is also placing controls on bauxite.

Clean energy policy is also creating 'friend-shored' trading blocs that Australia stands to benefit from:

- **IRA restricts China's access whilst supporting FTA trading partners:** Free Trade partners are considered domestic sources for some IRA policies, including for domestic content requirements related to critical minerals (includes Australia), however use of Chinese content is restricted.
- **Australia-US climate, critical minerals and clean energy transformation compact:** whilst the exact detail is still being developed, this compact's objectives are to accelerate the expansions and diversification of end-to-end energy supply-chains between the two countries which includes the supply of critical minerals, battery technologies and green hydrogen. It aims to enhance 'two-way' investment flows to achieve these objectives.
- **European Carbon Border Adjustment Mechanism:** Whilst this policy is not explicitly attempting to create a trading bloc it may have this effect as countries with relatively lower embodied emissions are advantaged in trade with Europe, this may favour Australia in some goods.

Australia is at a cross-roads; to capture the opportunity from the energy transition, it must take the 'on-ramp' presented by this new global paradigm

Take the "on-ramp" Strategically transform the economy to seize Australia's clean energy economic opportunity.

If responded to appropriately, the IRA and other international policy bolsters the clean exports opportunity for Australia through increased economic activity in 'friend-shored' trading blocs. This will require Australia to invest early to compete in the new paradigm, enabling the country to:

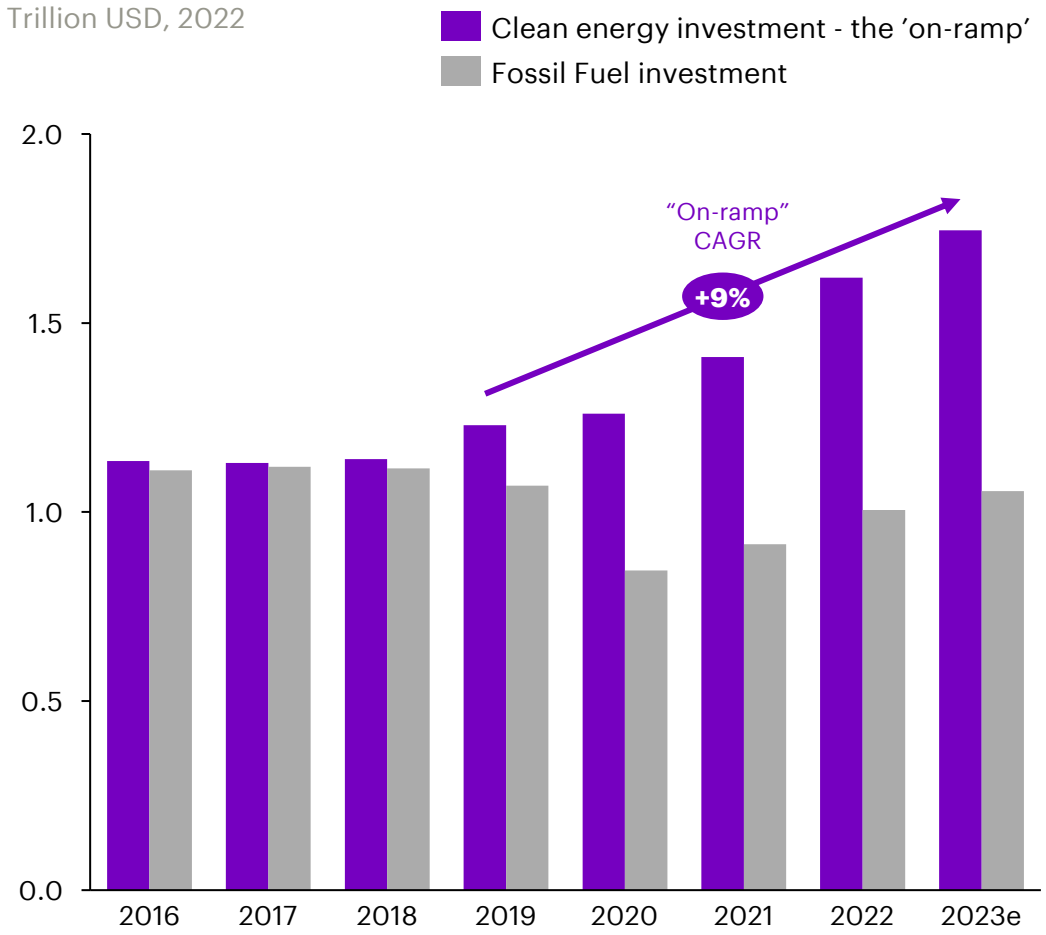
1. **Capture a larger part of the economic & social opportunity,** incentivising private clean energy investment onshore and creating jobs.
2. **Achieve a lower cost and faster energy transition,** investing early will ensure Australia has sufficient materials for the energy transition, and with at scale clean export industries, these materials may be at lower cost.

Take the slow lane Allow Australia's clean industry to fall behind, leading to a more costly transition.

Without a strategic response to the new paradigm, Australia's clean industry will be uncompetitive, making at scale clean industry less likely. Australia's economy, will remain dangerously exposed to the energy transition[1], leading to:

1. **A more costly energy transition,** Australia remains reliant on imports for clean materials during the energy transition which could lead to supply constraints and higher cost as global demand increases exponentially[2].
2. **The economy risks going through a period of decline during structural change,** Australia's fossil-fuel exposed exports are expected to decline, without industries that can fill the revenue gap, with transferable skill opportunities for fossil fuel workers, Australia's economy could see a period of decline.

Global private investment in energy



Notes: Notes: 1. 8 out of 10 of Australia's top exports are exposed through their reliance on fossil fuels - See further analysis in the original Sunshot report. 2. There is also a potential for increased supply constraints from geopolitical risk., 3. Adapted from IEA. Source: Accenture (2021), IEA (2023), Accenture analysis

Comparatively, other countries are investing $57-80b AUD across overarching clean energy policy when scaled to Australian GDP; $17-31b of this is related to clean industry

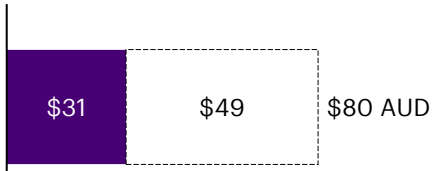
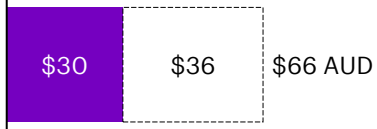
Competitor countries are investing $57-80b AUD across clean energy policy; $17-31b is directly related to clean industry

Billions AUD scaled to Aust. GDP

Clean industry related – direct investments in the clean industry policy pillar.

Cross-cutting – investments available to clean industry and other policy pillars.

Non-clean industry related – investments for renewable energy buildout, electrification and climate readiness.

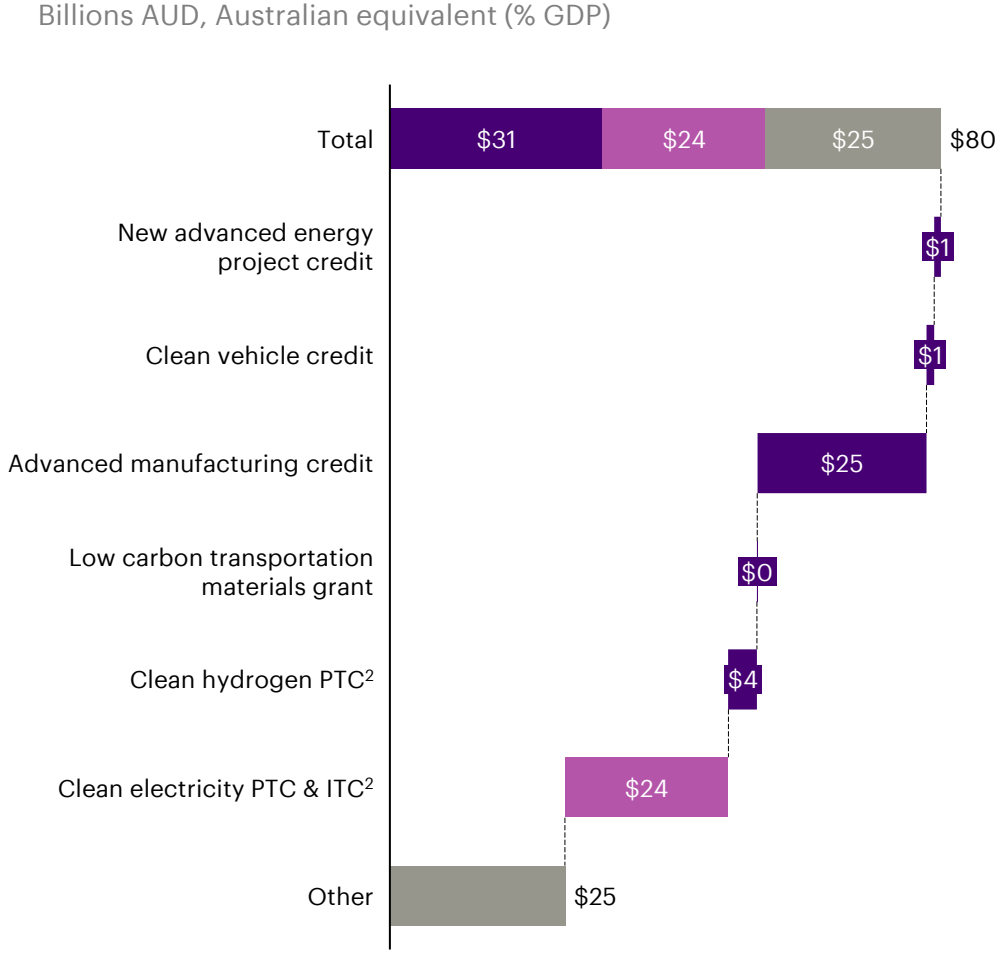
Country	Proportional level of investment	Areas of focus		Length	Other features
U.S Inflation Reduction Act[1]		• Clean electricity • Clean manufacturing (solar, wind, batteries) • Critical minerals • Clean transport (EVs & FCEVs) • Biofuels & SAF	• CCUS • Hydrogen • Electrification & efficiency • Conservation & adaptation	10 years	• The IRA also pursues other social objectives through bonuses and incentives for fair wages and benefits, apprentice utilisation, Just Transition and Environmental Justice.
Canada Made-in-Canada[2]		• Clean electricity • Clean manufacturing (solar, wind, batteries) • Critical minerals • CCUS	• Hydrogen	10 years	• Provisions for fair wages and benefits, apprentice utilisation, Just Transition and Environmental Justice. • Investments in expediting project approval times through improved planning and assessments & approvals.
Korea Green New Deal		• Clean electricity • Clean transport (EVs & FCEVs) • Hydrogen • Circular economy	• Industrial decarbonisation	5 years	• The Korean New Deal has created a co-investment package, 70% of funding came from the Korean treasury, with the rest coming from local governments and the private sector.
REPowerEU & France[4]		• Clean electricity • Critical minerals • Clean transport (EVs & FCEVs) • Hydrogen	• Electrification & efficiency • industrial decarbonisation (incl. green metals)	5 years	• The EU's policy utilises mandates along with 'carrots'; 40% of clean technology materials must be made in Europe with the CBAM shielding producers from cheap high emissions imports.

Notes: Considers investment as a proportion of a countries GDP and applies this to Australia's GDP, converted to AUD. U.S investment is USD$800B (3.2% GDP), Canada USD$71B (2.9% GDP), Korea USD$44B (2.6% GDP), Europe & France USD$411 (1% GDP).1. US gross total is $1.2T ($US800b) which includes ~$9.5b of IIJA funding for green H2. This considers Credit Suisse updated estimates of uncapped initiatives which sees an upside on CBO estimates based on an uptake of tax credits closer to expected uptake in a low emissions scenario. 2. Canada's gross total is $94b ($CA85b) which includes $5b of funding from 2022 budget for critical minerals referenced in the 2023 budget. 4. Includes REPowerEU, relevant funding from the 'Fit-for-55' package and French 2030 investment of EURO34. Source: Whitehouse (2022), Credit Suisse (2023), Joyce, C. & Stanford, J. (2023), BloombergNEF (2023), EU Commission (2022), Government of Canada (2023), World Bank (2023), Accenture analysis

The U.S IRA is investing $80b across overarching clean energy policy when scaled to Australian GDP; $31b of this is related to clean industry

U.S Inflation reduction act investment breakdown[1]

Billions AUD, Australian equivalent (% GDP)



Critical minerals	Green metals	Batteries	Green hydrogen	Other industry	RE gen.	Other
✔		✔	✔	Solar & wind		
✔		✔				
✔		✔		Solar, wind, components		
	✔					
			✔			
					✔	
						Transmission, climate readiness, electrification & efficiency, CCUS credit, Nuclear credit[4], biofuels

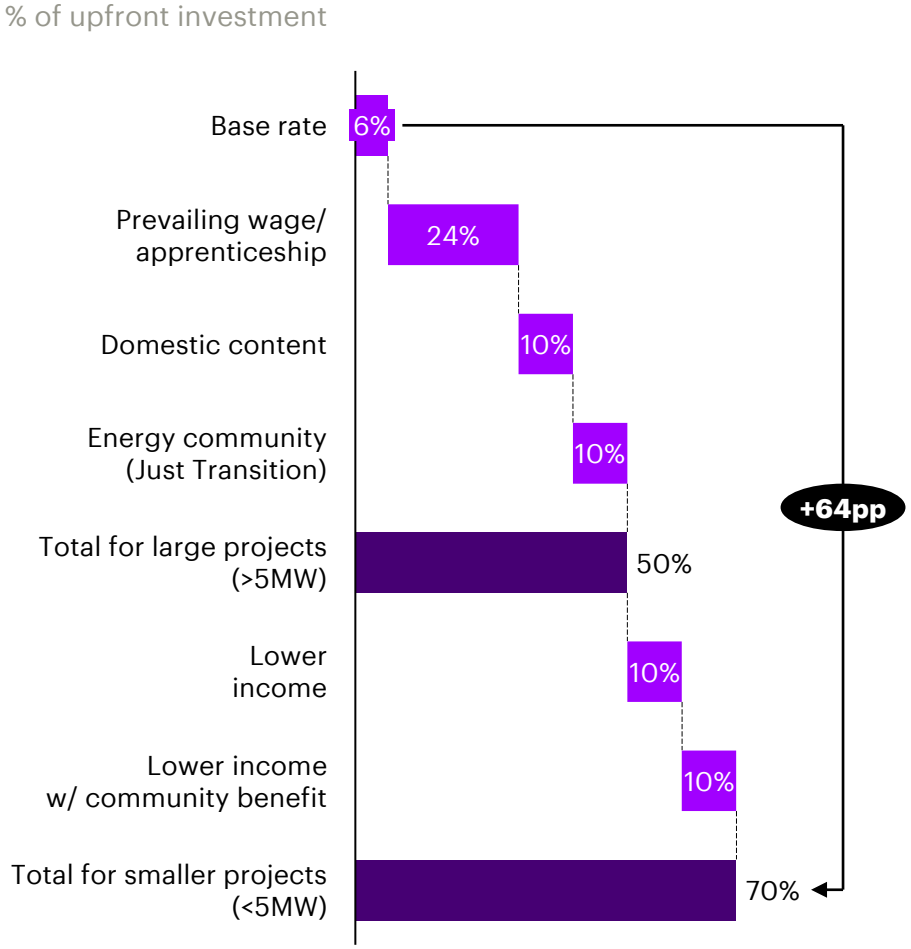
Notes: Figures adjusted to Australia based on spend as a % of jurisdictions GDP. 1. U.S gross total is $1.2T (US$800B) which includes ~$9.5b of IIJA funding for green H2, this considers Credit Suisse updated estimates of uncapped initiatives which sees an upside on CBO estimates, 2. PTC = Production Tax Credit, ITC = Investment Tax Credit, 3. transmission related investment sits in other. 4. Whilst nuclear has been considered in economies such as the U.S, Canada and EU, it is not considered as an option for Australia. Whilst the economics of nuclear may make sense in these economies due to historic capability and different costs of production, it is not considered economical in Australia compared to other sources of clean energy. Sources: Credit Suisse, Inflation reduction act, Congressional Budget Office, Accenture analysis

The U.S. IRA provides lessons in how to link investment in clean industry to social and environmental objectives

The IRA incentivises projects to meet prevailing wages, use local content & support Just Transition

Bonus	Requirements	Available to	Size
Prevailing wages & apprentice-ships	The proponent of the construction, alteration or repair of a facility or project must pay wages at prevailing rates for a similar character of work in the respective location. 10% of the total hours of the construction, alteration or repair is allocated to apprentices (rising to 15% post 2023).	RE electricity PTC/ITC	5x increase
		Advanced energy project Credit	30% increase
		Clean hydrogen PTC	5x increase
Energy communities	The facility/project is constructed in an energy community, classified as either a. an area with 0.17%+ direct fossil fuel employment or 25%+ local tax revenues from fossil fuels, and has an unemployment rate above the national average, b. where a coal mine has closed after 1999 or a coal-fired power plant after 2009	RE electricity PTC/ITC	10% increase
Low-income communities credit	10% bonus on the renewable energy PTC/ITC if a renewable energy project is on indigenous land or in a low income, increases to 20% if the project is part of federal subsidised housing programs or offers at least 50% of financial benefits of energy produced to low-income households	RE electricity PTC/ITC	10-20% increase

Cumulative investment tax credit as a % of upfront cost

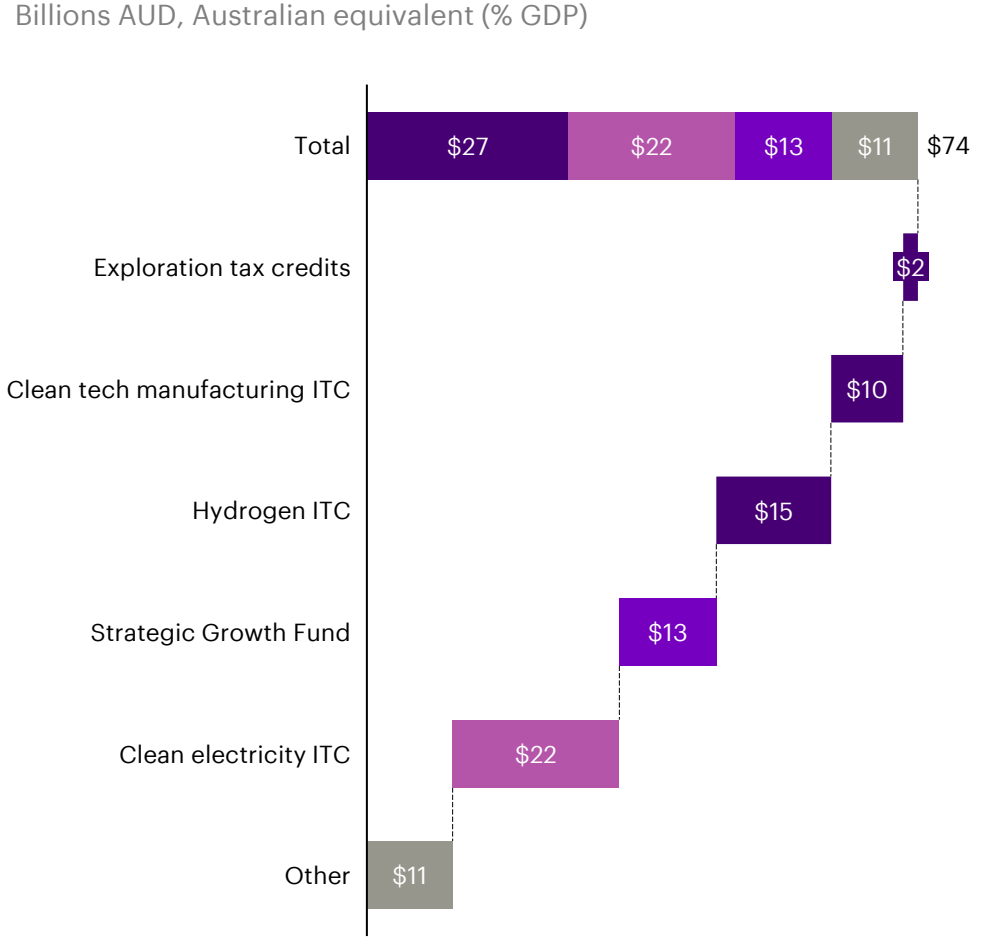


Source: Whitehouse (2022), Credit Suisse (2023), Accenture analysis

Made-in-Canada is investing $74b across overarching clean energy policy when scaled to Australian GDP; $27b of this is related to clean industry with $13b of strategic finance

Made-in-Canada investment breakdown[1]

Billions AUD, Australian equivalent (% GDP)

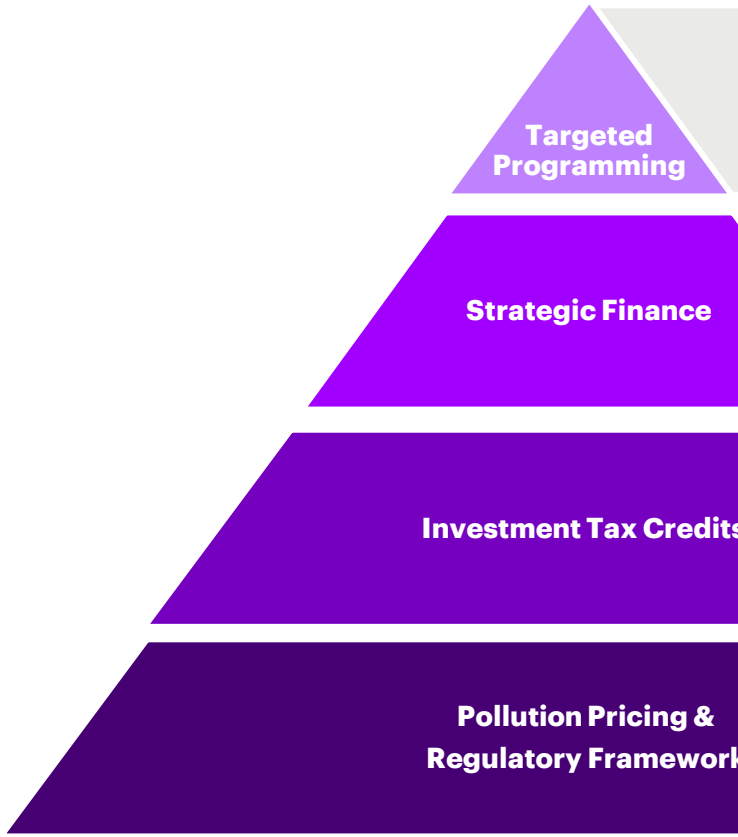


Critical minerals	Green metals	Batteries	Green hydrogen	Other industry	RE gen.	Other
✔						
✔		✔		Solar, wind, components		
			✔			
✔	✔	✔	✔	All low carbon tech	✔	All low carbon tech
					✔	
						Transmission, climate readiness, electrification & efficiency, CCUS credit, Nuclear credit[2], biofuels

Notes: Figures adjusted to Australia based on spend as a % of jurisdictions GDP. 1. Canada gross total is $94b (CAD$85b) which includes $5b of funding from 2022 budget for critical minerals referenced in the 2023 budget 2. 4. Whilst nuclear has been considered in economies such as the U.S, Canada and EU, it is not considered as an option for Australia. Whilst the economics of nuclear may make sense in these economies due to historic capability and different costs of production, it is not considered economical in Australia compared to other sources of clean energy. Sources: Canada 2023 budget, Canada 2022 budget, Accenture analysis

Canada's direct subsidies (ITCs) are used in conjunction with targeted programming, strategic finance and regulatory frameworks

Key features of the Made-in-Canada plan



	Canada's approach...	Lessons for Australia...
Targeted Programming	Canada has a Low Carbon Economy Fund, strategic innovation fund and Clean Fuels fund all providing targeted programmatic funding through the R&D lifecycle and scale up and deployment of clean energy technologies. These will continue driving the necessary advances in the energy transition.	ARENA plays a similar role in Australia and should continue to do so. Investing in Australia's R&D ecosystem will also be important to ensure we are funding projects all the way through the innovation to commercialisation lifecycle.[1]
Strategic Finance	The Canada infrastructure Bank and Canada Growth Fund both play an important role in providing strategic patient capital to businesses willing to invest in the energy transition. They fill a position in the market where lending is constrained due to high risks premiums from new technologies and markets.	CEFC and now the National Reconstruction Fund will play this role for Australia in providing strategic patient capital for the energy transition. The NAIF and EFA can also support large and/or export orientated projects.[1]
Investment Tax Credits	Canada is providing investment tax credits across its renewable energy buildout and clean industry policy. This will support them in levelling the international playing field and accelerating activity in their industries	In some instances, Australia will also need direct support to compete and win in the international landscape, this could be through tax incentives or other mechanisms such as contracts for difference.[1]
Pollution Pricing & Regulatory Framework	Canada has a large-emitter pricing system (carbon tax), clean fuel regulations and has reformed regulations to support faster assessments & approvals timelines and better community outcomes for large clean energy projects.	Australia has the Safeguard mechanism in place, which should be monitored for effectiveness especially upon its set review in 2026/27, further analysis is required to develop clean fuel standards and achieve robust, fair, timely & community driven assessments & approvals for clean energy projects[1].

Notes: Adapted from Canadian Government. 1. see further information in the policy analysis provided in section 3 and consideration of pre-committed investment in appendix. Source: Whitehouse (2022), Credit Suisse (2023), Accenture analysis

Contents

Australia needs a globally ambitious, proportionate and targeted clean export industry policy response

In addition to policies supporting renewable energy buildout as a foundation, and other electrification and climate readiness policies, direct support is required for clean export industries.

This report focusses on 5 prioritised clean exports within this policy pillar; critical minerals, green iron & steel, battery manufacturing, green hydrogen and green aluminum.

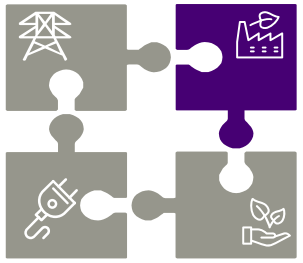
Direct policy support for these industries is especially important to offset the progressive loss of export revenues from Australia's already highly-exposed fossil-fuels export portfolio[1].

Policy should be designed to meet 4 principles; globally ambitious and proportionate, targeted on challenges to investment and building capability, built on clean energy and supporting decarbonisation outcomes and ensures workers, communities and the environment share in new value created.

Notes: 1. 8 out of Australia's top 10 exports are exposed to the energy transition – see further analysis in the original Sunshot report. Source: Accenture (2021), Accenture analysis

Australia should design its clean export industry policy on a set of 4 principles

Policy Priority



Clean exports industry policy

The following guiding principles should be considered for the clean exports industry pillar of an overarching clean energy policy. This reports detailed policy analysis considers 5 prioritised exports within this pillar. It does not suggest policy for other clean industries or for the other policy pillars (renewable energy buildout, electrification or climate & transition readiness)*.

Guiding Principles

01 Globally ambitious & proportionate

- Investment should seek to place Australia in a competitive, leadership position for the 5 prioritised export industries.
- This will require a proportionate response to international policy interventions (considering the impact of investment location and relative cost comparisons).

02 Targeted to unleash private investment, address challenges & build capability

- Policy design should be targeted towards overcoming challenges to investment in the clean export industries, with the goal of catalysing private investment.
- Policy should also build long-term capability to ensure that clean export industries can build sustainable competitiveness post-policy support.

03 Built on clean energy and supporting decarbonisation outcomes

- Development of export industries should consider their renewable requirement and how this interacts with other requirements, supporting additionality and ensuring Australia can meet decarbonisation targets.
- The substitution of our current fossil-fuel exposed exports to clean exports will significantly reduce scope 1 & 2 emissions – ensure this net impact is considered when designing overarching clean energy policy.

04 Ensures workers, community & the environment share in new value created

- Similar to the IRA, Australia should design policies in such a way to work towards societal and environmental benefits.
- This includes ensuring fair labour standards & Indigenous rights are upheld, designing for community benefit and Just Transition and ensuring clean industry policies help build a nature positive Australia.

**Further analysis is required into policy design for other potential industries and other clean energy policy pillars.*

5 clean export opportunities have been selected for analysis; this does not represent the limit of clean industry policy

Critical minerals, green hydrogen & ammonia, green iron & steel, green alumina & aluminum and battery manufacturing have been selected for detailed policy analysis in this report for two key reasons:

- **Potential for Australia to be a global leader in exports:** Australia has the strengths to, with policy support, produce these goods at a globally competitive cost. Whilst Australia could reasonably develop industries in other clean industry opportunities, potentially increasing domestic jobs and reducing reliance and money spent on imports, it is less clear whether Australia could lead in export markets.
- **Potential to offset the revenue and job loss from fossil-fuel exposed exports:** Australia's export-related revenue and jobs are at high-risk from the energy transition. New clean industries are needed that can 'fill the gap' from their decline. This requires the strategic build up of industries that can produce comparable revenues and job opportunities with skill and location transferability[1].

Notes: 1. Shortlist of export-related opportunities in original Sunshot report included professional services, these were deprioritised in this reports analysis due to less potential to offset the job less from decline in fossil fuel related exports. 2. Recycling of secondary steel and aluminum are considered in the green metal opportunities. Source: Accenture (2021), Accenture analysis

Australia could develop a breadth of clean energy industries; this report focuses on 5 only

Legend: Assessed for this policy analysis | Considered in other opportunities

Energy & materials	Critical minerals	1	Critical minerals (e.g. copper, cobalt, nickel, lithium, rare earths)
Technologies	Clean energy	2	Direct electricity (via undersea cables)
		3	Green hydrogen & ammonia
		4	Biofuels
	Green metals manufacture	5	Green iron & steel
		6	Green alumina and aluminium
	Devices & components manufacture	7	Heating and cooling technologies
		8	Wind turbine/ Solar PV components
		9	T&D infrastructure
		10	Electrolysers
	Energy storage manufacture	11	Battery manufacturing (active materials, cell & battery pack)
	Clean transport manufacture	12	Battery electric vehicles
		13	Hydrogen fuel cell vehicles
Services	Recycling[2]	14	Recycling of clean energy technologies & materials
	ICT & Data services	15	Software to operate clean energy systems
		16	Data-driven industrial operations
	Professional services[1]	17	Finance & investment
		18	Legal, accounting & consulting
		19	Design & engineering (e.g. microgrids)
		20	Education & training

A $38b clean export industry investment to 2034, across the 5 prioritised industries, can deliver the right settings to catalyse private capital and support the $314b opportunity

Policy objectives & mechanisms	Address short-term challenges Remove the immediate constraints to investment in clean export industries	Build long-term capability Create opportunities for clean exports to reach greater efficiency & scale	Raise ambition and win Proportionally re-level the playing field and realise the full clean exports opportunity
	Robust, fair, timely & community driven assessments & approvals[1]	Skill programs – NZA[2]	Production incentives (CFD or tax credit)
	International cooperation	Priority status in assessments & approvals for onshore value-add[1]	Hydrogen inputs incentives (CFD or tax credit)
	Government procurement	Strengthening and co-investing in Australia's R&D ecosystem	
		Funding industrial precincts – NZA[2]	
Investment			
2024-30:	$2.3b	$7.8b	$12.7b
2030-34:	$1.9b	$0.8b	$12.1b
Total:	**$4.2b**	**$8.6b**	**$24.8b**

Investment funding should be delivered over two stages; $23b between 2024-30 with a second stage investment of $15b to 2034.

This investment is related to five prioritised industries in the clean exports policy pillar only. Further assessment is required for policy actions in other pillars of Australia's clean energy policy.

*Pursuing investments across **all three objectives** will support Australia to meet its 2040 high ambition targets:*

- **$121b of value-adding critical minerals revenue** with ~60% from refining
- **$96b of green iron & steel revenue** producing 268mt of green iron p.a. **$26b of aluminium revenue** producing 5mt p.a.
- **$39b of batteries revenue** with 111GWh of manufacturing capacity
- **$32b of green hydrogen revenue** producing 15mt p.a.

Notes: 1. All policy analysis regarding assessments and approvals ensure that all current environment and regulatory requirements will only be enhanced. 2. Net Zero Authority, 3. Contracts for difference have been selected as an efficient and effective mechanism to deliver credits, however other mechanisms such as production tax credits can also be used to provide this. 4. Green iron & steel only – not aluminum - focused on incentivizing the required hydrogen for the green iron and steel opportunity, not production of green iron and steel. Further detail provided in appendix. Source: See appendix for full source list and methodology, Accenture analysis

Policies delivered through the $38b investment to 2034 should be focused on addressing short term challenges, building long term capability and raising our ambition to win

Policy mechanisms to drive investment for clean export industries

Critical minerals | Batteries | Green iron & steel | Green hydrogen | Cross-cutting

Billions AUD

Objective	Challenge addressed	Critical minerals	Green iron & steel	Batteries	Green hydrogen	Green aluminium	Investment (rounded)
Address short term challenges	• Regulatory disincentives • Assessments & approvals effectiveness & timelines • Trade barriers • Lack of domestic offtake	**Robust, fair, timely & community driven assessments & approvals:** Well-resourced place-based planning owned by communities and guided by best practice tools for nature and community impacts & engagement, supported by overarching national coordination and strategic regional plans. **International cooperation:**[1] Work towards removing trade barriers in battery import markets, encourage Lighthouse tenants to locate onshore, increasing domestic offtake.	**Gov. procurement:** for public infrastructure projects (steel) and Defence (batteries) with additional costs funded. **Retain unprocessed scrap steel onshore**				$4
Build long-term capabilities	• Lack of access to skills • Technical challenges • Lack of access to domestic feedstock • Lack of co-ordination	**Skills:** Deliver comprehensive skills programs which increase the capacity and availability of the domestic workforce to reduce construction delays in critical minerals and lack of technical knowledge in batteries. Also support knowledge transfers between steel & iron ore and LNG & hydrogen. **Priority status in assessments & approvals for onshore value-add:** for miners with supply agreements or integration with refiners and magnetite mines who supply to green iron. **Programmatic funding of NZA for coordination & industrial precincts:** funding should be provided to the Net Zero Authority to support the coordination of projects in co-located regions and industrial precincts, including shared infrastructure, industrial symbiosis and recycling partnerships. Funding should also support programs to connect stakeholders across the value-chain and create knowledge spillovers.	**Strengthening and co-investing in Australia's R&D ecosystem:** clear policy direction and targeted life cycle support, such as co-investment in commercialisation. This will enable Australia to pivot away from importing battery IP and expedite readiness and deployment of emerging technologies in green iron and steel.			$9
Raise ambition and win	• Unnaturally high & uncompetitive costs[2] • Competitor government support	**Production incentive[3]:** a 10% cost of production reduction is required to keep investment onshore in critical minerals refining.	**H_2 inputs incentive[3]:** A $1.9/kg reduction in cost is required for hydrogen to be cost competitive in displacing LNG for green iron and steel production.	**Production incentive[3]:** a $35-45/kwh[4] cost of production reduction is required considering the international playing in batteries. a proportionate ambition to Canada has been selected for the estimation. A $1.8/kg reduction in cost is required for hydrogen for export.		**Specific renewable buildout policy:** Aluminium needs firmed renewables at competitive prices (incentivisation is out of scope[5])	$25

Notes: Detailed policy implementation recommendations provided in appendix. 1. International cooperation policies must ensure that Australian labour standards and social objectives are being upheld. 3. Contracts for difference are an efficient and effective mechanism to deliver incentives as they will reduce in line with cost of production and green premium reductions, however other mechanisms such as production tax credits can also be used to provide this, see further discussion in appendix. 4.For cell and battery pack manufacturing respectively, Active Materials require a ~$470/t incentive See more detail in appendix. 5. Incentivising the renewable buildout is out of scope of this report, further information is provided in this section. Source: Accenture analysis

The $38b of public investment will crowd in further private investment; this could be 2.8x the initial public investment or more

The policy mechanisms used to deliver the $38b public investment, can support private capital to direct investments towards Australia; this is estimated at a baseline of 2.8x – actual private investments could be even higher considering recent national and international experience

AUD Billion

Mechanisms to address short-term challenges will create immediate opportunities for private investments and increase the ease of executing those investments in Australia through:

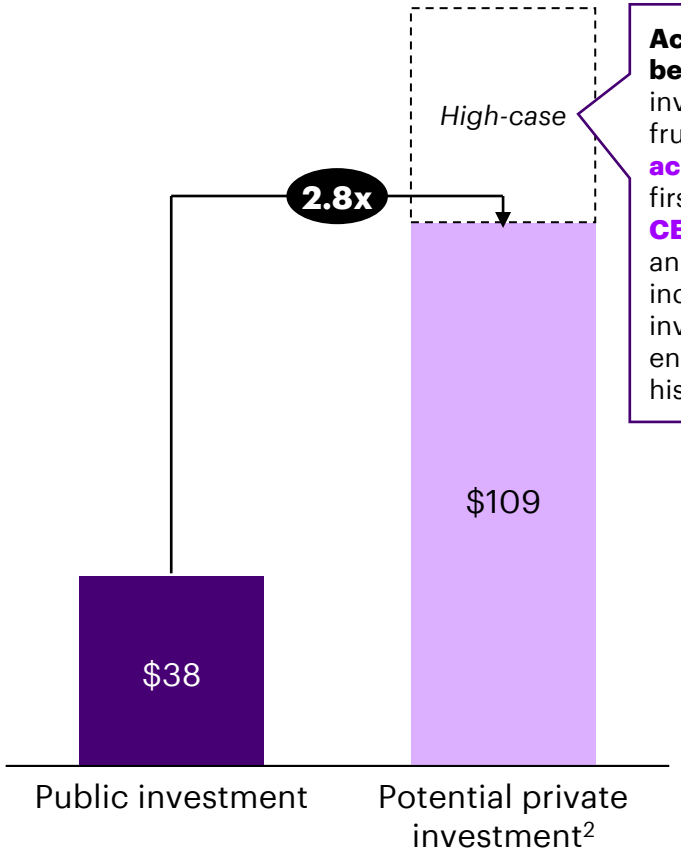
- Creating reliable sources of immediate domestic offtake,
- Reducing the time taken to deliver projects whilst ensuring fair outcomes for the environment, community and proponents, and,
- Reducing international barriers to trade.

Mechanisms to build long-term capabilities, can ensure that Australia remains a good place to do business overtime reducing cost of production though:

- Economies of scale through shared infrastructure and priority access to raw material feedstock,
- A strong and capable workforce delivering high quality products and,
- A strong R&D ecosystem increasing productivity through innovation and knowledge spillovers.

Mechanisms to raise ambition and win, will ensure investors can meet the same, or better, levels of returns in Australia considering the international environment through:

- Targeted & dynamic[1] production incentives that consider Australia's costs of production in relation to competitors for private capital
- Targeted & dynamic[1] input incentives that ensure hydrogen can replace fossil fuels economically in green iron & steel.



Actual private investment could be even higher; if announced investments in the U.S come to fruition, the **IRA will have achieved a 3.3x multiplier** in its first year. Closer to home, the **CEFC multiplier was 5x in 2023**, an all-time high. These both indicate trends that private investment multipliers in clean energy are trending higher than historic averages.

Notes: 1. Mechanisms such as contracts for difference can deliver incentives in a way that is targeted & dynamic in that public funding is only provided to projects that reach production of the desired good and the per unit incentive reduces in line with cost of production/green premium reductions, it may result in a higher proportion of private investment to public overtime. 2. See private investment catalysed methodology in appendix. For Raise Ambition & Win (production incentives) investment, the proportion of private investment required in critical mineral, battery, green iron & steel and hydrogen projects considering public subsidization is assessed. For all other investment mechanisms typical fiscal multipliers seen in historic global (Credit Suisse) and Australian experience have been used (ARENA & CEFC). 4. considering $400b of announced U.S investments and an average p.a. IRA public investment of $121b. Source: Source: Credit Suisse (2023), ARENA (2023), CEFC (2023), Accenture analysis

Policies should ensure fair working environments, a just transition, community benefit and First Nations partnership through requirements, standards and additional incentives

Outcomes	*How other nations have done this*	*How Australian policy could do this*	*What this looks like in Australia*
Safe and secure jobs with fair labour standards	**Canada Clean Industry Tax Credits:** Wages must follow the most recent multi-employer collective bargaining agreement & 10% of the labour hours must be performed by apprentices. **US IRA Prevailing Wages and Apprenticeships:** IRA tax credits are increased 5x for providing wages at prevailing rates for a similar character of work and allocating hours for apprentices.	• *Production & input incentives and government procurement:* require that projects must meet fair labour standards guaranteeing well-paid, safe, and secure jobs in order to receive incentive or tender	CASE STUDY **Inclusive hiring, training and fair wages at Geelong Big Battery** Construction firm UGL completed the Geelong Big Battery on time & budget while engaging a diverse workforce and delivering training & apprenticeship opportunities under wages & conditions negotiated with the Electrical Trades Union. 'Top up' labour during peak periods was sourced via a local contracting business with a union agreement, further benefiting local workers & the community.
A just transition for fossil fuel reliant communities	**Spain's Just Transition Agreements:** Workers, local government and communities are creating clean energy job banks, ecological restoration projects employing former coal workers, and prioritising investment in local renewable projects. **US IRA Energy Communities**: IRA tax credits receive a 10% bonus for projects in communities with high employment or a significant revenue from fossil fuels.	• *Production & input incentive:* provide bonuses to the incentive for projects located in transitioning regions as designated by Net Zero Authority • *Government procurement:* provide preferred provider status for projects located in transitioning regions	CASE STUDY **Gladstone's 10-year energy transition plan** Historically a centre for fossil fuel production and exports, the regional council of Gladstone has unveiled a 10-year energy transition roadmap and seeks to ensure equitable distribution of the resulting benefits across its community. A new apprentice training hub is being established as part of the Queensland Energy and Jobs Plan (QEJP).
Shared benefit for communities and First Nations	**US IRA Low-income & Indigenous Communities Credit:** IRA tax credits receive a 10% bonus if project is on indigenous land or in a low-income area, increases to 20% if the project is part of federal subsidised housing programs or offers at least 50% of financial benefits of energy produced to low-income households	• *Production & input incentives and Government procurement:* provide bonuses to the incentive or preferred provider status for projects with community benefits sharing arrangements • *Net Zero Authority standards:* for community & First Nations engagement[1]	CASE STUDY **The East Kimberley Clean Energy Project** In collaboration with Pollination Group and the Kimberley Land Council, traditional owners of the land MG Corporation and Balanggarra Aboriginal Corporation are spearheading the integrated development process using true co-design and co-decision making to reduce project development risk and shorten the development schedule.

Notes: See further information on the policies which consider additional incentives in the appendix. 1. This could reference best practice guidelines such as the First Nations Clean Energy Network Best Practice Principles for Clean Energy Projects. Sources: Whitehouse (2022), Government of Canada (2023), IEA (2021), Pollination Group (n.d.), First Nations Clean Energy Network (2022), Accenture (2023), Stakeholder consultation, Accenture analysis

A holistic approach that considers people, place and the full project/R&D lifecycle should underpin how policies are implemented

Key considerations to enable a holistic approach in policy implementation

In the implementation of...

- Robust, fair, timely & community driven assessments & approvals
- Skills programs
- NZA co-ordination of industrial precincts
- R&D ecosystems

Consider people

Policies should ensure that all stakeholders are being involved and considered during project planning, leading to better outcomes through fairer and more efficient community engagement and assessments & approvals, with shared benefits. When designing industrial cluster policy and community engagement processes, specific skill and knowledge basis of locations should also be taken into consideration and leveraged.

Consider place

Through co-ordinating industrial precincts, economies of scale can be achieved for projects, whilst reducing overall system costs through efficient use of infrastructure, energy and resources. Coordinated place-based planning can also benefit nature by identifying appropriate sites for development and protection leading to faster decisions, greater certainty and environmental protection. Skills and R&D programs can benefit from co-location due to knowledge spillovers.

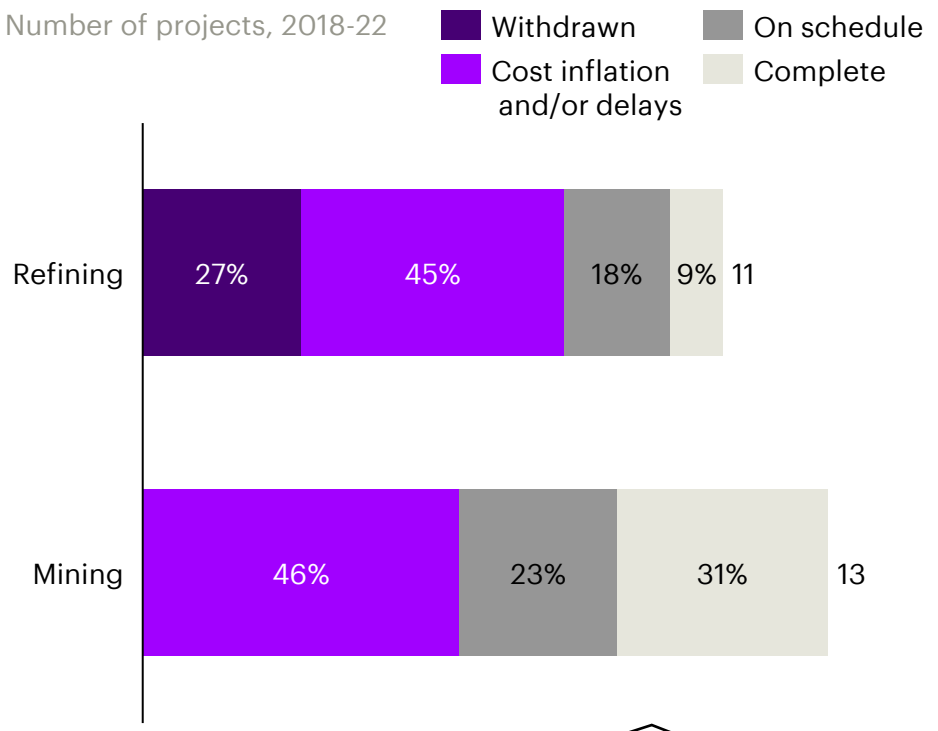
Consider lifecycle

Project and R&D lifecycles need to be considered in the development of industrial precinct and R&D policy. Precincts must consider the full lifecycle of projects including decommissioning, rehabilitation and circularity. Cultivating the R&D ecosystem requires support throughout the lifecycle of R&D from early-stage research to commercialisation. R&D policy should be developed considering requirements at different stages of technology readiness levels (TRL) to ensure pioneering projects are able to reach commercialisation at speed.

Notes: considerations of people, place and lifecycle should reference recommendations and best practice guidelines set out in the CleanAction Coalition's Nature-Safe Energy report and the First Nations Clean Energy Network Best Practice Principles for Clean Energy Projects Source: Climateworks Centre (2023), Science and Technology Australia (2022), CleanAction coalition (2023),First Nations Clean Energy Network (2022), Accenture analysis

While Australia has seen significant investment into new critical minerals projects, many are facing significant cost inflation, leading some to consider moving offshore

Lithium project pipeline in Australia



Mining and refining CAPEX spending is expected to be 4x higher over the next 3 years than the previous 8 years, driven by workforce shortages[1]. Australia has also experienced higher inflation (6%) in 2023 compared to other countries such as Japan (3.3%) and South Korea (2.3%), exacerbating cost inflations.

CASE STUDY

Australia's first lithium hydroxide plant struggles to meet demand on cost inflations

Production at Kwinana refinery, Australia's first lithium hydroxide plant, fell 85% in the June quarter compared to the march quarter this year. This follows significant cost inflations in early 2022, which doubled the expected price of their lithium hydroxide. Delays also prompted two customers to cancel purchase agreements. IGO and Tianqi Lithium are not alone in experiencing production difficulties, with other refineries operated by Albemarle and Wesfarmers also struggling to meet production targets.

CASE STUDY

Delays at integrated lithium mining and refining project in Mount Holland

The Mount Holland lithium project is expected to cost $300 million (20%) more than originally anticipated. Covalent Lithium (50:50 joint venture of Wesfarmers and SQM) attribute delays to workforce shortages, refinery engineering challenges and covid restrictions delaying the delivery of key capital items required for construction. With the mine and concentrator originally planned for completion in 2019, it has been delayed to start production in early 2024. Meanwhile, the refinery won't be operational until 2025, previously scheduled for 2021 when the project was first announced.

CASE STUDY

Pilbara Minerals taking lithium hydroxide refining to South Korea

Pilbara Minerals and POSCO secured $682 million in funding from government owned banks to construct a lithium hydroxide plant in South Korea. The plant will source spodumene from Pilbara Minerals' lithium mines in WA. Besides government funding, lithium processing plants are 40% cheaper to construct in South Korea than in Australia, exacerbated by Australia's construction workforce shortages and cost inflations. The announcement makes Pilbara minerals the 2nd company to move lithium refining offshore this year, with Liontown Resources Ltd exploring Lithium refining in Japan.

Notes: 1. whilst Australia is currently experiencing relatively high employment, the high demand in mining and refining construction is outstripping the available workforce. Source: DISR (2018, 2019, 2020, 2021, 2022), Mckinsey & Company (2023), Trading Economics (2023), Ker, P. (2023), Thomson, J. (2023), Fernyhough, J. (2023), Fernyhough, J. (2022), Iannucci, E. (2023)

Additional support is required to address short term cost increases and build long term capabilities to unlock Australia's critical mineral opportunity, especially in refining

Key challenges to Australia's critical mineral opportunity

High and uncompetitive costs: Capex costs are significantly higher in Australia (~2.5x higher than China for lithium hydroxide) due to construction delays. Refiners are moving offshore to access incentives.

Long assessments & approvals and lack of coordination: Miners face land access challenges and up to 10 years in lead time to obtain the necessary approvals across federal, state and local government.

Skill shortage: Construction shortages are being felt across Australia; for example, at least 51% of the 85,000 workers required to construct and operate renewable energy infrastructure by 2030 are in national shortage occupations. Shortages are exacerbated in rural locations.

Low access to domestic feedstock for refiners: Australian refiners are exposed to high import costs and supply risk by competing in the global market. This doubles feedstock costs, increasing total production costs by about 58%.

Potential clean industry policies to address challenges

Policy objective	Potential policy mechanisms	Barriers addressed
Address short term challenges	• **Robust, fair, timely & community driven assessments & approvals:** Well-resourced place-based planning owned by communities and guided by best practice tools for nature and community impacts & engagement, supported by overarching national coordination and strategic regional plans.	
Build long-term capabilities	• **Skills:** Work with relevant Jobs and Skills Councils to identify technical skill gaps and labour shortages to deliver targeted training, apprenticeship and upskilling programs. This should consider skill transferability from existing fossil fuel workforces.	
	• **Priority status in assessments & approvals:** Place miners that have contracted current or future supply to domestic refiners (or who plan to integrate downstream themselves) at the front of queues.	
	• **Programmatic funding of Net Zero Authority:** Provide funding to support the coordination of resources across the value-chain and development of shared-use infrastructure in priority regions, allowing greater opportunity for critical minerals operations to integrate and scale.	
Raise ambition and win	• **Production incentives:** A 10% subsidisation to the cost of production for critical minerals refiners can reduce the outflow of investment offshore and alleviate historically high costs[1].	
	• **Support downstream advanced manufacturing:** Provide incentives for downstream manufacturers in batteries to increase domestic demand and develop the value chain *(see battery policies assessment)*.	

Notes: 1. Contracts for difference are an efficient and effective mechanism to deliver incentives as they will reduce in line with cost of production and green premium reductions, however other mechanisms such as production tax credits can also be used to provide this. See further information on policy mechanisms and methodology for implementation size in appendix. Source: Industry consultations, DISR (2023), Accenture (2023), Frost, N. (2023), Accenture (2022)

Steelmaking using direct reduced iron has emerged as a primary decarbonisation pathway, mobilising producers to capitalise on Australia's iron ore and projected low-cost hydrogen

Global demand for green steel is growing with investments and announcements; France is investing US$4b in grants for industrial decarbonisation and Germany has spent US$2.2b to decarbonise Thyssenkrupp, China has pledged to reach peak emissions from its steel by 2025.

This has mobilised producers to explore investment opportunities to decarbonise. Domestic operators such as Fortescue, BHP and GFG Alliance have made investments in low-carbon infrastructure as well as research & development. Key international steel producers, such as Baowu and Posco, have established a presence and investment in Australia.

There is a growing direct reduced iron market given its ability to decarbonise steel, but technological advancements and magnetite investment is required for Australia to capitalise on this. Hematite accounts for 96% of Australia's iron ore exports but is not compatible with current predominant DRI production pathways. Magnetite, however, is compatible with current DRI technology. More magnetite needs to be brought online yet there is a disincentive due to costs and carbon liability from higher energy intensities. Technological advances are required to unlock a lower cost hematite pathway in the long-term.

Hydrogen is required at scale. Following a green hydrogen pathway for DRI is key as the use of natural gas would result in an increase in domestic emissions. However, green hydrogen costs need to reduce from US$2.24kg to US$1/kg to supplant natural gas.

Green iron and steel activity in Australia by domestic and international producers

GFG Alliance	GFG Alliance are phasing out coal-based steelmaking at Whyalla with the purchase of an electric arc furnace. They plan to use the DRI pathway.
FMG Fortescue	FMG's R&D into using magnetite ore for green iron has enabled proprietary technological breakthroughs.
BHP	BHP has partnered with the University of Newcastle in the Centre for Ironmaking Materials Research, with funding to support research into decarbonising steelmaking.
BAOWU	Baowu signed and MoU to jointly advance steel decarbonisation projects, including optimisation of pelletisation technology, for Australian iron ores and low-carbon iron production in Western Australia.
posco	Posco plans to invest AUD$12b in green steel with its local partners by 2040 and has secured a land lease in the Boodarie Strategic Industrial Area to produce HBI

CASE STUDY

Whyalla—partnership between steel & mining, enabled by gov investment

GFG Alliance (Liberty Steel) is leveraging its SIMEC Mining arm to create an integrated steelworks facility using magnetite iron ore. This includes plans for a direct reduction plant capable of transitioning to green hydrogen when commercially available. This has been enabled though an AUD$593m green hydrogen plant funded by the South Australian government. This has spurred a $AUD2b residential development project, signalling a new and revived future for the industrial precinct and its community.

CASE STUDY

Rio Tinto partners with H2 Green Steel to use Canadian iron ore to decarbonise

Rio Tinto is leveraging its high-quality Canadian iron ore reserve to produce pellets for H2 Green Steel's flagship plant, one of the world's first large-scale producers of low carbon iron and steel. Unlike reserves in Canada and Brazil, Australia's iron ore is less compatible with current key DRI technologies. As such, low-cost hydrogen will be key to unlocking a competitive production cost for green iron and steel.

Sources: World Steel Association (n.d.), BHP (2022), Austrade (n.d.), Liberty Steel Group (2023), Rio Tinto (2023), Geoscience Australia (2023), MRIWA (2023), Rio Tinto (2023), Global Australia (n.a.)

Integrating Australia's scrap steel into the value chain using EAFs can help advance decarbonisation while emergent technologies develop, as well as embed circular economy

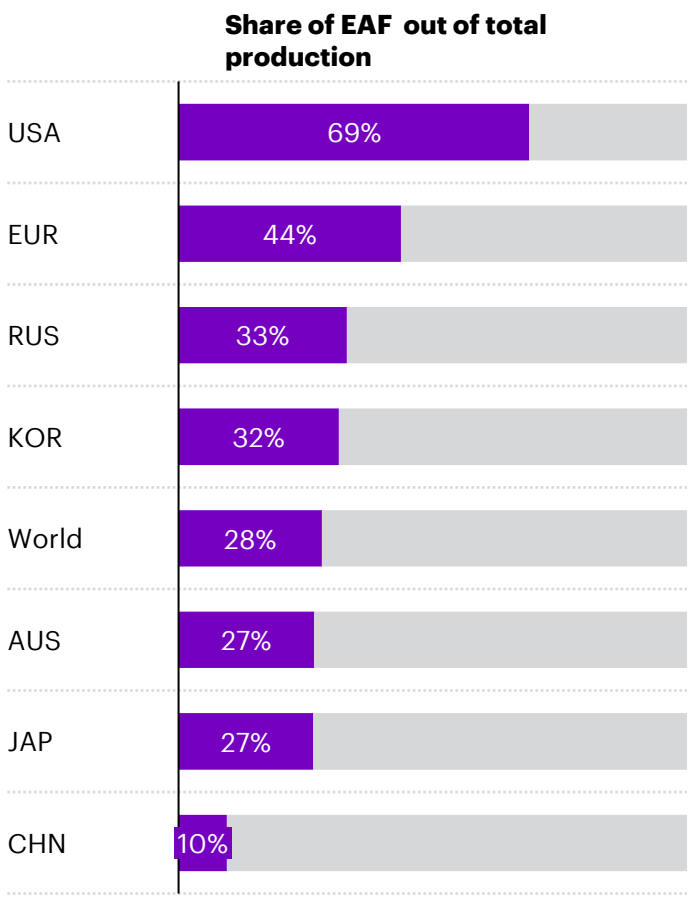
Scrap electric arc furnaces (EAF) are a mature, low-carbon and cost-competitive steel production route
Recycling steel scrap is a key decarbonisation lever as it reduces the demand for ore-based production as well as the emissions intensity of primary production. EAFs are a readily available technology and scrap-EAF production costs of ~US$410/t are comparable to the traditional carbon-intensive BF-BOF costs of ~US$400/t.

Australia can leverage the scrap-EAF route to increase the capacity of its steel industry while reducing carbon intensity
EAF currently accounts for only 27% of Australian steel production, placing it below the world average at 28% and significantly behind the U.S and Europe at 69% and 44% respectively. However, with comparable production costs to BF-BOF, as well as lower operating costs and initial capital expenditure, EAF is a cost-competitive and low-emissions route for Australia to increase its steelmaking capacity.

Access to domestic steel scrap and renewable energy will be key to enable a zero-emissions and cost-competitive scrap-EAF route
The primary cost driver of scrap-EAF are costs of scrap steel, accounting for ~75% of production cost, followed by electricity cost. As such, Australia needs to capitalise on its own scrap supply. There have been calls from industry to ban steel scrap exports as ~2 mt are exported annually, which could be used to replace ~37% of Australia's primary steel production. This has required steel producers to import 100kt of steel scrap to meet their needs. With regions such as the UK and EU exploring the potential of export curbs, Australia needs to ensure its steel producers have access to domestic scrap. Producers will also need access to reliable, low-cost renewable energy to enable a zero-emissions and cost competitive scrap-EAF pathway.

Rates of Steel-Making via Electric Arc Furnace

% of total steel output, 2022



CASE STUDY

Western Australia's first steel mill: Collie Green Steel Mill

The Collie green steel recycling mill will use an electric arc furnace powered by renewable energy. With an annual capacity of 400kt per year, the plant will turn scrap steel from Western Australia into rebars for domestic and export purposes.

The plant will abate 800kt of CO^2e per year and create 200 long-term jobs in the area, and up to 2000 indirect jobs. The project, having received partial funding of $2.7M of grant support from the Western Australian Government, is in the advanced stages of development. It is expected to begin operations in 2026.

This is in part a result of Collie's Just Transition plan which has brought together industry, community, unions and government to maximise opportunities for Collie as it transitions from a coal-based community.

Sources: World Steel (2023), DISR (2023), Institute for Energy Economics and Financial Analysis (2022, 2021), Green Steel WA (n.a.), Australian Steel Institute (2022)

Accessing cost competitive hydrogen, incentivising more magnetite mines & onshore value-add, and advancing technology will be key to achieving high ambition targets

Key challenges to Australia's green iron and steel opportunity

Increased energy intensity and higher carbon liability: Australian producers face a risk of paying a higher cost of carbon, especially if LNG is used in the interim instead of green hydrogen.

Dependency on renewable energy build out: renewable energy is required at scale for a completely green iron & steel pathway steel. Multiple barriers exist to this buildout[1].

Access to iron ore compatible with direct reduction technology: Magnetite iron ore is more compatible than hematite with current predominant technology. However, 71% of new magnetite mining capacity is currently projected to begin operation only after 2028.

Technical advances needed to unlock a hematite iron ore pathway: Advancing a hematite ore pathway can reduce productions costs (16% lower than magnetite pathway) and increase feedstock supply.

Coordination of infrastructure and skills: new infrastructure will be required in key mining regions to supplement existing capabilities as well as the application and adaptation of existing skills to new processes and technologies.

Low access to domestic scrap steel: Australia is not capitalising on domestic scrap, exposing production costs to volatile scrap prices.

Low-cost hydrogen : The green hydrogen industry itself is nascent and highly capital intensive, accounting for 88% of total capital costs across a green DRI value chain.[2] Furthermore, current green hydrogen production costs are higher than the ~US$1/kg required to supplant natural gas in the production of DRI.

Potential policies to address challenges

Policy objective	Potential policy mechanisms	Barriers addressed
Address short term challenges	• **Regulatory coordination**: Ensure net-positive impacts in emissions reductions are adequately accounted in addition to considering on-shore emissions.	
Build long-term capabilities	• **Renewable energy buildout policies:** further policies are required to coordinate and incentivise the build out of renewable capacity, transmission infrastructure and storage at speed and scale while delivering community, nature and First Nations benefits[3].	
	• **Priority status in assessments & approvals for magnetite mines supplying to green iron operations:** Place miners that have contracted supply to domestic iron and steel producers (or who plan to integrate downstream themselves), or who are developing magnetite, at the front of queues.	
	• **Strengthening and co-investing in Australia's R&D ecosystem**: Reduce barriers to commercialising technology, incentivise knowledge-sharing and ensure breakthroughs made in Australia will be deployed on-shore.	
	• **Retain scrap steel on-shore:** Extend existing policy to curb waste exports scheduled for July 2024 to include unprocessed scrap steel. [4]	
Raise ambition and win	• **Hydrogen input incentives:** Provide incentives to reduce the cost of hydrogen, this can be provided to a green iron or steel producer who is developing captive hydrogen or directly to hydrogen projects who have contracts or intent to supply to green iron and steel, an incentive of $1.9/kg is required[5]	

Notes: See further information on policy mechanisms and methodology for implementation size in appendix. 1. See further discussion on challenges to renewable buildout on p.60. 2. Scope of capital costs included are 50/50 mixed solar wind, batteries, hydrogen facility and ammonia facility. 3. Australia's renewable energy transition is not in scope for this report, thus renewable policies are not included as part of the final set of recommended policies. 4. Countries such as the UK and European Union are exploring the potential of export curbs on scrap steel. 5. incentives could be is expected to reduce overtime with declining cost of production/green premium. Sources: Industry consultations, MRIWA (2023), The Energy and Resources Institute (2021) , Geoscience Australia (2018)

Australia's upstream capabilities present an opportunity to compete in a targeted battery manufacturing market long term if international subsidies are addressed

Cost of production - Cell manufacturing

$AUD/kWh

To match the US production tax credit of $35/kWh, Australia would need to spend over $9 billion in the next 5 years

Cost of production – Battery pack assembly

$AUD/kWh

To match the US production tax credit of $45/kWh, Australia would need to spend over $11.5 billion in the next 5 years

Comparison of mineral production and reserves

Percentage of world total, 2021

Higher ■ ■ ■ ■ Lower

Production | Reserves

	Lithium		Cobalt		Nickel[2]		Copper		Graphite		Manganese	
Australia	55	26	3	18	6	22	4	11	-	2	17	18
United States	1	3	<1	<1	<1	<1	6	5	-	<1	<1	<1
China	14	7	1	1	4	3	9	3	82	23	7	4

Opportunity for Australia

1. **Australia can be competitive in battery mining, refining and active materials:** Australia is already cost competitive in lithium mining and has significant reserves in other materials. Australia could unlock further cost advantages by integrating feedstock downstream into refining and active materials. Domestic refining and active materials are well placed to capture market share from China, who are excluded from the US IRA.
2. **With targeted policy support, Australia can leverage upstream capabilities to develop a diversified battery industry:** The US IRA has reduced Australia's competitiveness. Policy support could partially close the gap in the short term, but Australia must act now to avoid falling further behind. In the long term, Australia can develop a diversified battery industry by leveraging cost advantages upstream. Policy should focus on cell manufacturing, as battery pack assembly will naturally follow. By addressing these barriers, Australia could be seen as a reliable export partner as countries look to diversify supply chains from China.

Source: Accenture (2023), Accenture analysis

Unlocking Australia's battery opportunity requires targeted policy to reduce costs and build skill and technology capabilities, while even more policy ambition is required to win

Key challenges to Australia's battery opportunity

High and uncompetitive costs: Manufacturers are moving offshore to access incentives. The US IRA can reduce costs by up to 19%. Australia also has high capex costs and lenders have a low-risk appetite.

Trade barriers: Australian battery exporters are facing tariffs of up to 15% in some key markets (i.e. India).

Long assessments & approvals and lack of coordination: New projects are taking up to 2-3 years in lead time to obtain the necessary approvals across federal, state and local government.

Skill shortage: About 34,700 additional workers are required in battery industries by 2030; over 50% of these worker are in national shortage occupations.

Lower access to battery technology: Australia has limited access to battery technologies and IP and lags R&D investment, which has historically been about 3.5x higher in the UK and 12x higher in the US

Low access to customers: Australia has a limited customer base with no domestic scale OEMs, limiting the domestic demand for active materials, cell manufacturing and pack assembly.

Potential clean industry policies to address challenges

Policy objective	Potential policy mechanisms	Barriers addressed
Address short term challenges	• **Robust, fair, timely & community driven assessments & approvals:** Develop well-resourced place-based planning owned by communities and guided by best practice tools for community impacts and engagement and benefiting nature, supported by overarching national coordination and strategic regional plans.	
	• **International co-operation[1]:** Negotiate removal of trade barriers in key market and encourage Lighthouse tenants to locate onshore to support supply chain development.	
	• **Government procurement:** Set requirements for relevant government contracts to use batteries with minimum domestic content components.	
Build long-term capabilities	• **Skills:** Work with relevant Jobs and Skills Councils to identify technical skill gaps and labour shortages to deliver targeted training, apprenticeship and upskilling programs. This should consider skill transferability from existing fossil fuel workforces.	
	• **Co-invest in Australia's R&D ecosystem:** Establish a fund to support development of Australian battery IP	
	• **Programmatic funding of Net Zero Authority:** Increase programmatic funding to support the coordination of resources across the value-chain and development of shared-use infrastructure in priority regions	
Raise ambition and win	• **Production incentive:** Establish an incentive of $35/kwh for cell manufacturing and $45/kwh for battery pack manufacturing[2]	

Notes: See further information on policy mechanisms and methodology for implementation size in appendix. 1. All international cooperation measures must ensure that Australian labour and environmental objectives are upheld. 2. Contracts for difference are an efficient and effective mechanism to deliver incentives as they will reduce in line with cost of production and green premium reductions, however other mechanisms such as production tax credits can also be used to provide this. Source: Industry consultations, Accenture (2023), Accenture (2022), IEA (2023)

Green hydrogen's role in global decarbonisation is evolving; to capture the emerging demand, Australia needs to bridge current cost gaps and realise its pipeline of projects

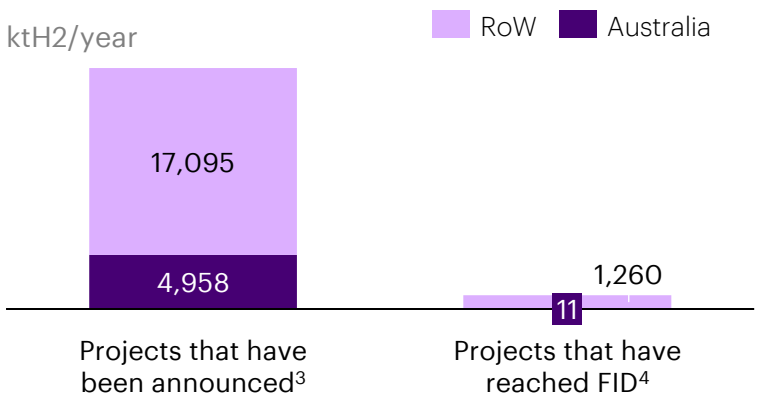
Green hydrogen's role in global decarbonisation is still evolving yet a growing set of countries have announced import targets. Hydrogen will be increasingly used in the decarbonisation of heavy industry, such as steel. Key trading partners such as Japan, South Korea and Europe have announced intentions to import 300kt, 800kt and 10mt respectively by 2030.

Australia is well placed to meet this demand in the medium-term as a cost competitive producer. Declining electrolyser and renewable energy costs coupled with higher load factors can enable an accelerated cost decline curve, reducing farm gate costs from US$2.3/kg today to US$1.5/kg by 2030.[1] Furthermore, Australia is well placed to service domestic and export markets with the world's largest share of forecasted production capacity at 23%.

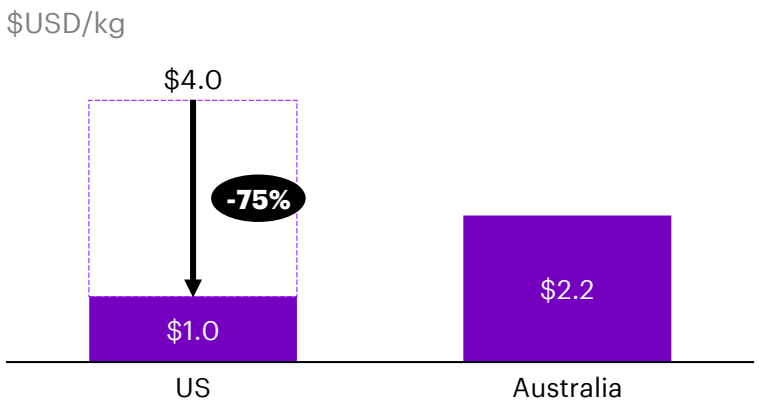
However, Australia is at risk of losing out on first-mover offtakes due to demand-side and supply-side challenges. The domestic iron and steel industry requires a lower production cost of US$1/kg for green hydrogen to be more cost competitive than liquified natural gas. Export partners Japan and South Korea also seek production prices of US$1.1/kg. The US IRA has reduced their production costs by ~75% to now be in this target range, drawing producers and investment away from Australia.

Projects in Australia's current pipeline are struggling to meet FID due to demand uncertainty and cost. Australian projects account for only 1% of global projects having reached FID. There is demand uncertainty and a lack of domestic offtake coupled with renewable buildout delays which are limiting Australia from realising its potential cost advantages[2].

Australian projects are not meeting FID, partially due to a lack of domestic offtake and renewable capacity



The IRA has reduced U.S H2 costs by 75% eroding Australia's production cost competitiveness



CASE STUDY

Fortescue Future Industries "actively expanding its US presence" with A$35m purchase of the Phoenix Hydrogen Hub

The US IRA's production tax credit has reduced production costs to the US$1/kg target range required to supplant fossil fuel, unlocking a green hydrogen opportunity for domestic and export markets.

As part of "actively expanding its US presence", FFI has acquired the Phoenix Hydrogen Hub (PHH) with the planned 80MW electrolyser producing up to 12kt of green hydrogen. FFI chief executive Mark Hutchinson has cited that incentives combined with access to domestic and export off-take agreements are key considerations in identifying markets to operate in. The PHH project is projected to reach final investment decision this year.

Notes: 1. This is the farm gate cost under an accelerated development scenario. 2. See further discussion of challenges to renewable buildout on p. 60. , 3. This is based on the global pipeline of announced projects that have entered demonstration, feasibility study, final investment decision, construction or operation with a disclosed start year for operation and type of electricity. 4. Only projects that have entered final investment decision, construction or operation with a disclosed start year for operation, type of electricity have been included. Sources: Clean Energy Finance Corporation (2021), Rocky Mountain Institute (2021), Ker, P. (2023), Parkinson, G. (2023), Bowler, J. (2023)

To ensure Australia's capabilities grow in lock-step with emerging demand, Australia needs to build on the Hydrogen Headstart program and scale up ambition

Key challenges to Australia's hydrogen opportunity

Embedding green hydrogen into a reconfigured industrial ecosystem: Collaboration across industries and government is needed to enable focused infrastructure development as well as reconfiguration of the industrial ecosystem for long-term scalability, sustainability and synergy.

Dependency on renewable energy build out: Delays to development of transmission, renewables and storage prevent green hydrogen production and the ability for producers to unlock efficiencies from adopting a grid-balancing role.

Rapid workforce development: Centralised training offerings are not keeping pace with industry needs. While manufacturing companies are filling in the gap, they have increasing influence on pricing (and therefore access) given their proprietary knowledge.

Competitor government support: The IRA has reduced production costs by ~75%,[1] making US producers better placed to capture emerging export demand. This has also drawn producers and investment away from Australia. Australia's Hydrogen Headstart program's $2b funding scope will select 2-3 producers however will not meet the requirements of high ambition targets.

Potential clean industry policies to address challenges

Policy objective	Potential policy mechanisms	Barriers addressed
Address short term challenges	• **Unlock domestic demand:** coordination and incentivisation of domestic iron and steel industry in production of green direct reduced iron (see green iron and steel policies).	
Build long-term capabilities	• **Programmatic funding of Net Zero Authority: :** Increase programmatic funding to support formation of hydrogen hubs and industrial clusters. This should consider leveraging industrial precincts to enable expedited processes, industrial symbiosis and prioritised development of shared infrastructure in designated transition regions as appropriate.2	
	• **Renewable energy buildout policies:** further policies are required to coordinate and incentivise the build out of renewable capacity, transmission infrastructure and storag at speed and scale while delivering community, nature and First Nations benefits[2].	
	• **Reshape centralised skills programs:** Identify and address technical skill gaps in current programs through co-creation with industry, unions, academia and manufacturers. This should consider skills transferability from existing industries, such as the liquified natural gas industry.	
Raise ambition and win	• **Production incentives:** To address international competition and push more Australian projects to FID, an incentive of $1.8/kg is required[3].	

Notes: See further information on policy mechanisms and methodology for implementation size in appendix. 1. The IRA has introduced a production tax credit of up to US$3/kg which can lower production costs to US$1/kg. 2. Australia's renewable energy transition is not in scope for this report, thus broad-based renewable policies are not included as part of the final set of recommended policies. 3. See further discssuion on Contracts for difference are an efficient and effective mechanism to deliver incentives as they will reduce in line with cost of production and green premium reductions, however other mechanisms such as production tax credits can also be used to provide this. Sources: Industry consultations, Longden et al. (2020), IEA, (2022), 2022), Department of Climate Change, Energy, the Environment and Water (2023, 2023), Beasy et al. (2023), Accenture analysis

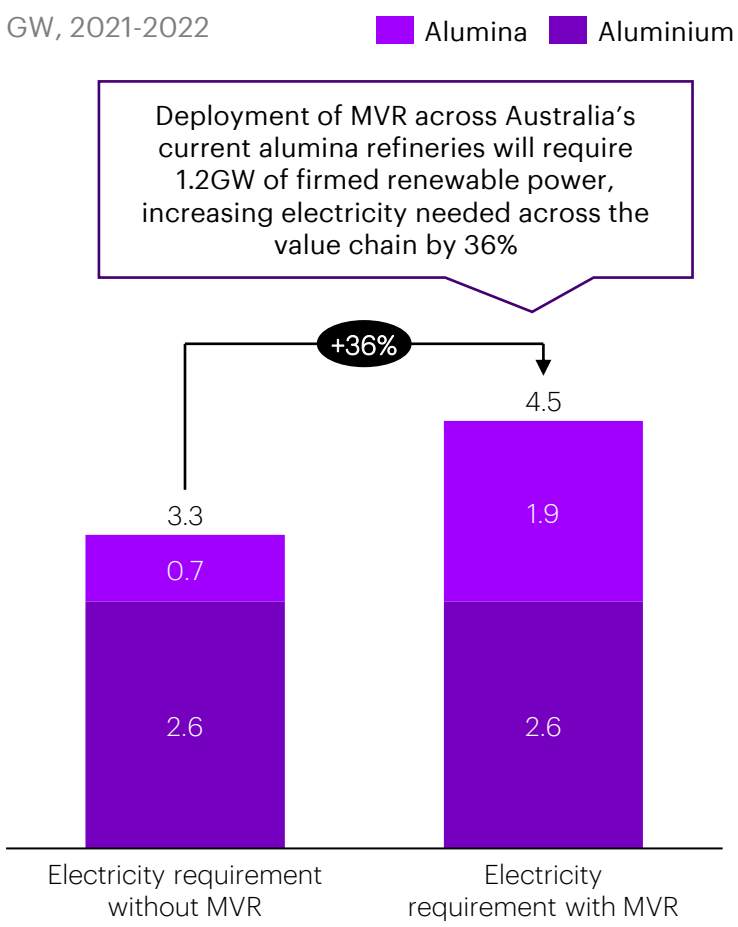
Australia's alumina and aluminium industry is well poised to grow and decarbonise through use of emerging technology, renewable energy and domestic scrap supply

Producers are already developing clean technologies to leverage Australia's existing leadership in bauxite and alumina. Producers in Australia are looking to capitalise on a growing preference for green aluminium. Globally pioneering projects led by key producers are underway in Australia supported by state and federal funding, such as Alcoa's mechanical vapour recompression (MVR) technology. This would enable Australia to increase on-shore value-add of historically exported bauxite and alumina while decarbonising the global aluminium value chain.

However, viability and cost competitiveness rests on a firmed supply of low-cost, renewable energy.
The aluminium industry is highly energy and carbon intensive. Energy is the key cost driver, typically accounting for 30-40% of costs. Producers are exposed to variable energy prices and shortages, with financial and operational impacts resulting in multiple smelters having faced closure.[1] While emerging technologies can help transform the industry, a large proportion of these technologies look to electrify mechanical processes that are historically powered by fossil fuels with adoption of MVR alone will increase the industry's electricity requirement by 36%. As such, the scale and timeliness of delivering firmed, low-cost renewables is ever more critical in unlocking sustainability and financial viability.

Leveraging Australia's scrap aluminium can enable decarbonisation and circularity.
Secondary aluminium production produces ~3% of emissions compared to primary production and technologies are readily available. However, more than 95% of Australia's scrap aluminium is currently exported for recycling as recycling on-shore is currently not commercially viable.

Emerging decarbonisation technologies will require more electricity in the form of firmed renewables[2]



CASE STUDY

Rio Tinto writes down Gladstone assets in the absence of low-cost, firmed renewable energy

High energy prices has affected the viability of Rio Tinto's alumina refineries and smelters, resulting in the write-down of Boyne smelter. Combined with the introduction of Australia's carbon regulatory policy, Rio Tinto has also written down its Yarwun alumina refinery, citing high costs of building decarbonisation technology and purchasing carbon offsets as having significantly reduced the book value.

Renewable energy had been identified by Rio Tinto as a key decarbonisation lever that could also bolster financial feasibility. It had called for large-scale wind and solar proposals in 2022 and more recently expressed that a guaranteed supply of firmed, competitively priced renewable power would enable it to undertake some underwriting of large-scale clean energy projects.

Despite the recent write-downs, Rio Tinto has expressed hope in its Gladstone assets being repowered with renewable energy, citing that this would improve Boyne's cashflows.

Notes: 1. Aluminium smelters that have faced closure include Rio Tinto's Boyne facility in 2023, Alcoa's Point Henry facility which closed in 2014. 2. Requirements have been calculated based on Australia's alumina and aluminium outputs in 2021-2022. Sources: Australian Financial Review (2023, 2023), Rio Tinto (2022), BloombergNEF (2021), Mission Possible Partnership (2023), ARENA (2022)

Enabling a green alumina and aluminium industry is contingent on timely, large-scale build out of firmed renewables and technical advances

Key challenges to Australia's aluminium opportunity

Dependency on renewable energy build out: Uptake of key technologies will require broader ecosystem development, including firmed renewable generation. However, delays to the development of transmission, renewables and storage are currently experienced. This jeopardises Australian producers' financial and operational feasibility as well as their ability to decarbonise, placing them at risk of paying a higher cost of carbon under the Safeguard Mechanism.

Unlocking grid-firming through alumina refineries to increase responsiveness and resilience of aluminium industry as well as the energy system: Aluminium smelters have historically provided a variety of services to support grid stability and reliability, but at the detriment to their own operational and financial feasibility. As alumina refineries increasingly adopt electrification technologies to decarbonise, there is an opportunity for refineries instead to leverage their flexibility to provide effective demand management and help alleviate the burden on smelters.

Aluminium recycling is currently not commercially viable: Due to geographic dispersion and lack of domestic manufacturing, aluminium recycling at scale is currently not commercially viable.

The key policy pillar to accelerate the Green Alumina & Aluminum opportunity towards high ambition targets is the Renewable Energy Buildout. This pillar is out of scope of this report's detailed investment design.

- Future detailed design should consider how to provide players in the aluminum industry with access to internationally competitive firmed renewables.
- This may include providing incentives for developers specifically providing for aluminum or covering some of the additional cost of firmed renewable contracts.
- Future analysis into these potential options should account for the full requirements of all industries and domestic demand across the renewable energy buildout to ensure policies are coordinated and achieving maximum effectiveness at least cost.

Potential clean industry policies to address challenges

Policy objective	Potential policy mechanisms	Barriers addressed
Build long-term capabilities	• **Coordinate development of mechanisms to address energy peaking:** Ensure that alumina refineries, once they have adopted electrification technologies, are adequately supported and incentivised to undertake demand-side response interventions as opposed to aluminium smelters doing so[1]	
	• **Net Zero Authority to enable coordination across industry (including for co-ordinating scrap):** Facilitating collaboration between alumina refineries and aluminium smelters to jointly deliver demand-side responses for grid stability and reliability. Supporting development of industrial clusters and partnerships across the value chain for aluminium recycling as Australia's domestic manufacturing capabilities grow.	

Notes: See further information on policy mechanisms and methodology for implementation size in appendix. 1. Australia's renewable energy transition is not in scope for this report, thus the renewable energy policies are not included as part of the final set of recommended policies. Sources: Industry consultations, ARENA (2022), Western Australia Government (2022), Rio Tinto (2023), Energy Transitions Initiative (2023)

Further policy will be required to build-out the renewable capacity required for clean exports

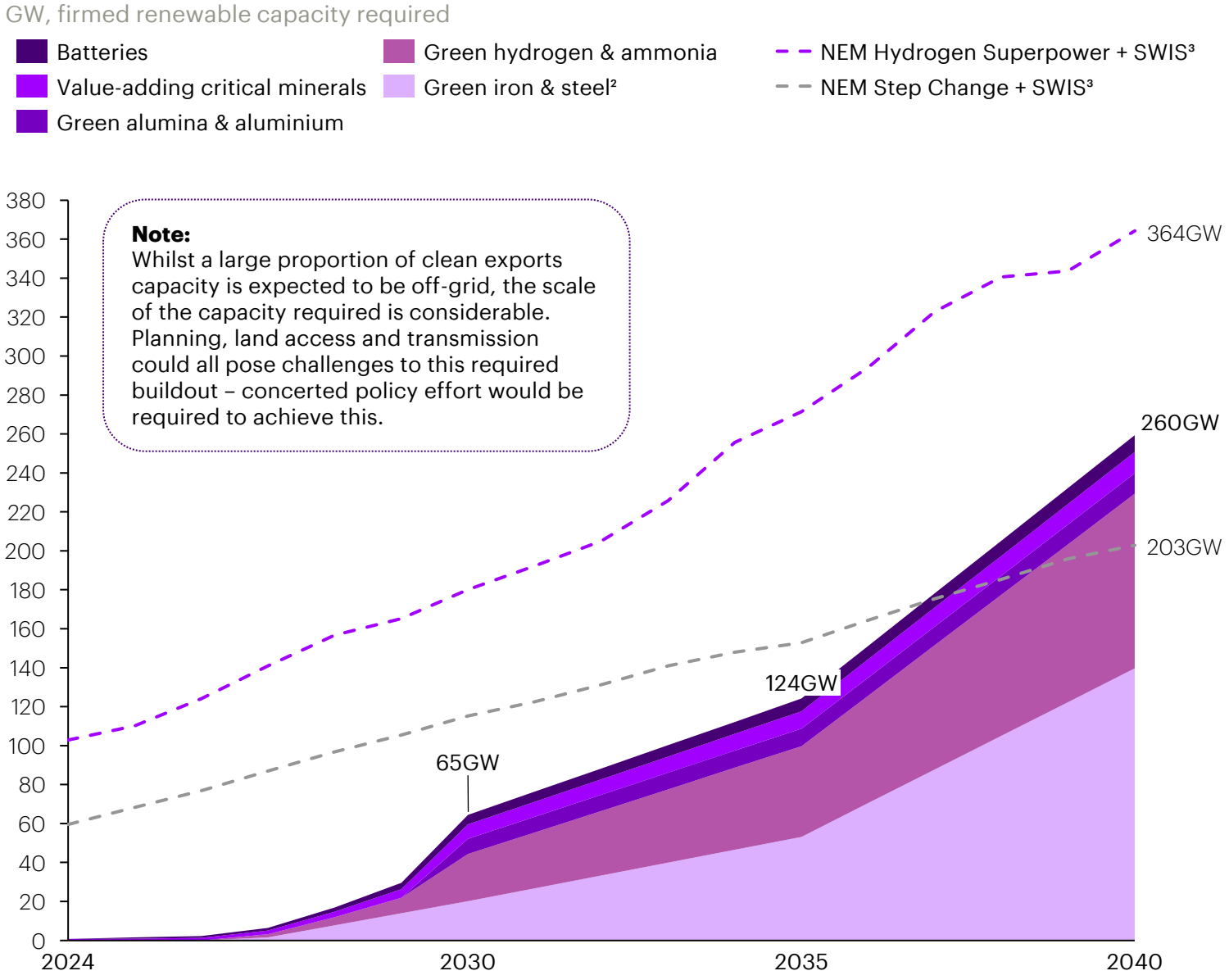
A large portion of international clean energy policy is focussed on sufficient renewable buildout. This will also be vital in Australia both to meet national decarbonisation targets and ensure the entire value chain of the export industries are powered by renewables.

Significant renewable energy capacity will be required to enable the five export industries. This is especially critical for green hydrogen, green iron & steel, as both are highly energy intensive and contingent on access to low-cost and reliable renewable energy.

Australia will need to increase the speed and scale of its renewable buildout in line with trajectories following an exports scenario.[1] Current challenges being seen in the build-out of renewable energy such as transmission, permitting issues and lack of storage will need to be overcome to enable Australia to unlock its clean export industries. Australia's renewable energy build-out will need to evolve in line with both domestic and export needs as it continues to decarbonise and carve out its role in a global low-emissions economy.

Notes: 1. Projections from the AEMO 2022 ISP has been used as the full 2024 ISP Report has not yet been published at the time of writing. 2023 IASR and ESSO forecasts do not include additional capacity requirements by technology i.e. renewable vs non-renewable (estimates are for consumption). 2. The renewable energy requirement for green iron and steel assumes a decarbonised value chain from mining to processing. 3. Based on capacity additions under a Techtopia scenario in the WA 2020 WOSP. 4. Further assessment on challenges to buildout provided in section 3.Sources: IEEFA (2020), MRIWA (2023), Alcoa (2022), AEMO (2022, 2023, 2023), DISR (2023), ARENA (2017), Kelly, J. C., Wang, M., Dai, Q., & Winjobi, O. (2021), Northey, S. A. & Haque, N. (2014), Energy Transformation Taskforce (2020)

The 5 selected Clean export industries will require significant renewable energy capacity



The renewable buildout faces challenges in managing variability, grid integration, planning and high costs

An electricity system based on renewables needs mechanisms to address periods of varying generation such as storage and demand management.

The nature of where the most efficient renewable energy sources are located will require a large buildout of transmission to integrate it. Furthermore, digital upgrades are required to support variability.

The buildout of renewables will require large amounts of land (for example, solar requires 37km^2/TWh – 2.7x higher than coal[1]). It is important that communities are engaged and can share in the benefits so that developers have the social licence to use this land. We must also ensure that projects are good for nature so that the increased land requirement does not cause environmental harm.

It will be important for Australia to build sovereign clean industries to ensure it has the materials required for the renewable buildout without meeting supply constraints. Government support through policies such as the U.S IRA may incentivise international developers to invest in projects offshore – Australia's renewable buildout policy pillar must consider how to respond to this.

Notes: 1. See Cleanaction, WWF, 2. This is most pronounced in the U.S where production tax incentives have costs for solar and wind 50-30% lower than Australia's. U.S low case LCOE for solar = $16/MWh and Wind = $11/MWh considering production tax credits with prevailing wage bonuses. Australia low case LCOE solar = $32/MWh and wind = $37/MWh. All prices AUD. Source: Whitehouse (2022), Credit Suisse (2023), CSIRO (2023), Energy Transitions Commission (2021), CleanAction coalition (2023), Accenture analysis

Policy is required to overcome the challenge to renewable energy buildout

01 Managing variability

Insufficient storage: storage needs to be deployed at scale to overcome variability. Whilst there is a wide range of technologies for daily storage, with costs reducing (e.g. batteries), longer and seasonal storage is more complex and expensive and will require separate incentives and interventions to unlock (e.g. pumped hydro).

Mismatched demand profiles: a lot of energy demand occurs during times of low renewable generation. Demand needs to be shifted and shaped to compliment renewable generation, this can be incentivised through new market & regulatory design (e.g. markets for demand flexibility, incentives and better support to integrate DER & behind-the-meter solutions).

02 Integrating with the grid

Insufficient transmission & grid infrastructure: projects must be built where there is high renewable penetration and resource potential, this is not always where grid infrastructure is located. New infrastructure including transmission lines and interconnectors need to be built, to enable a more dynamic electricity market that shifts energy from generation to demand more efficiently.

Smart grids to enable variable and distributed assets: more variable energy requires smarter and more flexible grids which consider and enable small-scale and distributed generation behind-the-meter. Smart technologies are also required to optimally dispatch firming technologies, shift & shape demand profiles and/or send timely market signals.

03 Planning and community acceptance

Lack of strategic regional planning: well-resourced national, state and local level planning is required to properly understand and mitigate a comprehensive and cumulative set of social and environmental impacts, whilst ensuring projects are being developed efficiently (i.e. maximising energy whilst minimising space). If done early, with appropriate communication, this strategic planning can give greater certainty of process to communities, stakeholders and proponents and lead to more timely and fairer outcomes.

Land access issues: caused by a complex set of issues varying by location. This includes lack of trust, engagement and planning or process inefficiencies from proponents, governments and local stakeholders. This can all lead to a lack of community acceptance causing delays or outright cancellation of a project.

04 Relatively high costs

Supply-chain constraints: constraints in the supply of manufactured products such as solar panel, wind turbine components, transmission cables and electrolysers are causing delays and higher costs in some renewable energy projects.

Competitor government support: Whilst Australia has relatively low renewable LCOEs compared to the rest of the world, new international policy support is decreasing costs in other countries and attracting developers[2].

Note: *A policy response is required to address these challenges and must be considered in conjunction with the clean export industry policies assessed for the 5 prioritised industries in this report.*

Policy makers should focus on four guiding principles when developing renewable energy policy to overcome challenges in a way that is good for nature and communities

01

Plan for maximum efficiency to minimise total generation and transmission needs

Pursue co-location and renewable energy zones to create efficiencies through economies of scale and shared infrastructure. This will also minimize damage to nature by placing energy infrastructure on already disturbed ecosystems, close to cities and regional industrial precincts.

Maximize energy productivity through energy efficiency to reduce the overall amount of renewable energy, storage and transmission infrastructure required. This will save money, resources and impacts on nature.

02

Make sure people benefit so that social licence for renewables is maintained

Ensure renewable developments attain free, prior and informed consent of Traditional Custodians[1] to ensure that First Nations Peoples have a seat at the table during development and can benefit from developments on their Country. First nations should be engaged from initial project planning and throughout the lifecycle, with clear, accurate and accessible information, cultural heritage must be preserved and protected, and benefits should flow to communities[2].

Promote the highest standards of community participation and engagement across development, construction, operation and decommissioning of projects. Where possible, projects should support local communities, services and jobs and provide benefits such as reliable, affordable energy. Fair compensation should be paid to affected communities. Early planning that is strategic in considering climate, communities and nature is essential to deliver this.

03

Protect and regenerate nature

Ensure all projects are assessed through rigorous and independent EIAs[3], including assessing cumulative impacts across projects and regions and adoption of the precautionary principle, with independent and accountable assessment and decision making.

All projects should avoid harmful impacts to nature, and where impacts are unavoidable, deliver sustainable and durable gains for nature. Early strategic planning is also key to avoiding harmful impacts to nature by ensuring that we develop the right types of renewables in the right. Rigorous implementation of the mitigation hierarchy (avoid, reduce, restore) is fundamental. Exemptions or lower standards for environmental protection should not be used as this undermines trust in the regulatory system.

04

Promote new approaches to how we interact with energy

Shift behaviour to focus on energy efficiency and time of use. Design policy, markets and regulation to incentivise energy efficiency or optimal time of use (e.g. shifting demand profiles to when more renewables are in the grid, creating markets or auctions for demand flexibility and storage capabilities) rather than having profit motives linked to increased consumption.

Design for distributed interconnectivity: support a distributed but interconnected system so that periods of intermittency and periods of high generation can complement each other across locations. The interconnection of generation and storage assets, including new energy assets like electric vehicles, can all support the system balancing. This will require a smart grid, optimising and balancing in real-time and incentives for distributed asset owners to join such systems.

Key challenges supported: Insufficient storage; Mismatched demand profiles; Transmission & grid infrastructure; Smart grid requirements; Land access issues; Lack of planning & coordination; Supply-chain constraints; High cost against competitors

Notes: 1. as outlined in the UN declaration on the Rights of Indigenous Peoples, 2. This can equity and co-ownership opportunities, jobs or other benefits. Best practice guidelines such as the First Nations Clean Energy Network Best Practice Principles for Clean Energy Projects exist to support this. environmental impact assessments. 3. Source: ACF (2023), Energy that is good for nature and people (forthcoming), UNESCO (n.d), Accenture (2022), CleanAction coalition (2023),First Nations Clean Energy Network (2022) Accenture analysis

Local content in renewable buildout can drive clean industry demand & increase renewable capacity through a positive feedback loop

Renewable energy buildout will create demand for clean energy materials - for example utility-scale solar and onshore wind will require large amounts of green steel, aluminium and critical minerals. Additional demand will come from other clean energy technologies such as offshore wind, rooftop & thermal solar and electrolysers.

Batteries, and their embedded materials, will also be required at scale domestically (around 43GW of additional storage capacity will be required to 2040[1]).

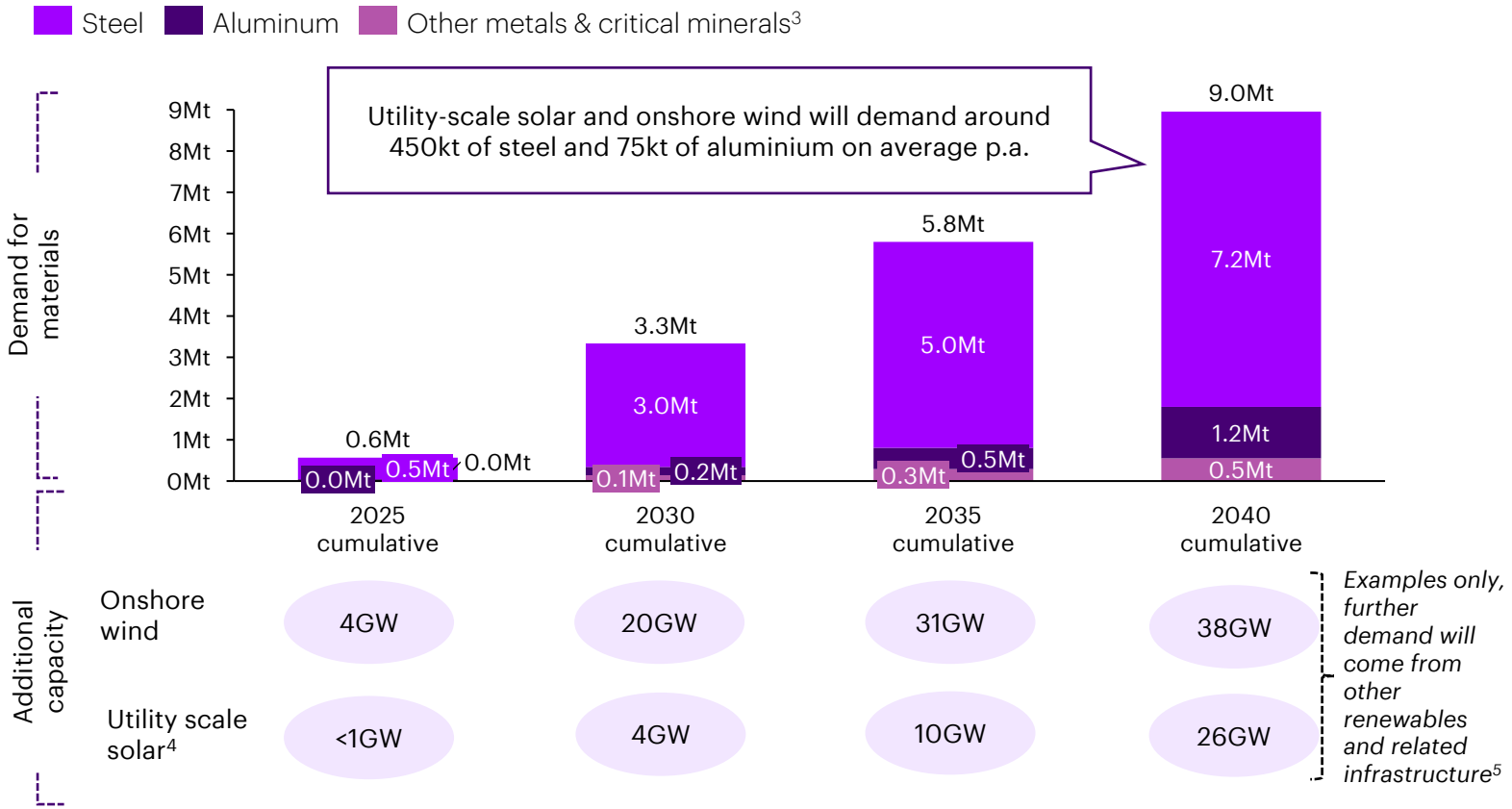
Linking renewable energy buildout to requirements or incentives for local content will direct this demand towards local producers, supporting domestic offtake for the clean export industries. Further, this creates a positive feedback loop as the domestic clean material industries also drive demand for renewables.

Local content requirements should be considered in policy design for the renewable energy. For example, additional incentives could be provided for renewable developers if local content is used.

Notes: 1. including both utility scale and distributed storage (AEMO Step Change), 2. steel, aluminum and critical mineral requirements for wind and solar taken from meta-analysis of estimates from Liang, Y et al. 3. includes; copper, nickel, silicon, zinc, molybdenum, manganese and others. 4. does not include solar thermal or distributed PV, 5. For example transmission and distribution infrastructure and storage, 6. For example, Victorian Local Jobs First Policy, NSW RESB. Source: Liang, Y et al. (2022), AEMO ISP Step Change (2022, 2023, 2023), Whitehouse (2022), EU Commission (2022), Accenture analysis

For example, solar and wind buildout can generate over 9mt of metals and minerals demand

Million tonnes of metals and minerals[2], GW of solar and wind capacity, both cumulative to 2040



Domestic local content requirements can link renewable energy buildout policy with clean industry policy by ensuring the demand for clean energy materials is directed towards domestic producers. This can be done though requirements or incentives linked to renewable energy buildout policy, for example:

- The US IRA increases the tax credit available to renewable energy developments for use of local content (10% increase on the credit if 40% of materials are domestic),
- The EU mandates that 40% of clean energy materials must be made domestically by 2030,
- Some Australian State Governments use a points-based system for public tenders, providing an allocation of points for domestic content to drive its selection[6].

Contents

Appendix i: Policy implementation parameters

Production and inputs incentives

Description

A direct incentive/subsidy linked to the production of a unit of a good in the prioritised industry, it can be delivered through multiple mechanisms[1].

Rationale for mechanism selection

Australia's cost of production in the addressed industries is too high to compete in the international landscapes considering other policy interventions. A short-term intervention is required. The size of the per unit incentive considers Australian and international production costs.

Key design considerations

- To qualify projects should meet requirements for fair labour standards[2].
- Bonuses should be designed for projects in fossil-fuel communities (as defined by the NZA) or who are sharing benefits with the communities where they operate[2].
- Measures to ensure strict governance and avoid gaming of the system/rent-seeking behaviour should be employed[3]

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Critical minerals[1]	• High construction costs • Uncompetitive playing field	On average a 10% reduction on production costs is estimated to be required to re-level the playing field.[4]
Batteries[1]	• Uncompetitive playing field	On average a $35-45/kwh reduction for cell manufacturing and battery pack manufacturing and $470/t for active materials is required to level the playing field.[4]
Green hydrogen[1]	• Uncompetitive playing field	On average a $1.8/kg reduction is required to level the playing field.[4]

What are inputs incentives

A direct incentive/subsidy required to purchase/produce an input (e.g. hydrogen) required for a good. This can also be delivered through multiple mechanisms[1].

Rationale for mechanism selection

Green iron & steel cannot purchase or produce green hydrogen at the required price point to make green iron and steel economical. A short-term incentive is required to ensure hydrogen specifically for green iron and steel use can be built at the required rates to meet high ambition targets.

Key design considerations

- To qualify projects should meet requirements for fair labour standards[2].
- Bonuses should be designed for projects in fossil-fuel communities (as defined by the NZA) or who are sharing benefits with the communities where they operate[2].
- Measures to ensure strict governance and avoid gaming of the system/rent-seeking behaviour should be employed[3]

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Green iron & steel	• Access to low-cost hydrogen	A $1.9/kg reduction is required to produce hydrogen at the required price to substitute out LNG in green iron production.[4]

Notes: 1. see next page for potential implementation mechanisms, 2. see further information in section 3. design considerations will depend on cons of mechanism selected, see next page, 4. Assessment conducted on Australia's average costs of production versus global competitors and subsidy support available, see total size and methodologies in appendix. Sources: Accenture analysis

Production and input incentives can be delivered through multiple mechanisms including contracts for difference and production tax credits

Potential policy mechanisms to deliver incentives

Mechanism	Description	Pros	Cons	Case examples
Contracts for difference	Developers submit to tender the strike price required to meet their required return on a project considering their cost of production and subsidies available internationally. The government will pay the developer for whatever the difference is between the actual price and their required strike price. In the extent that the market price moves above the strike price, the government/taxpayer can share in some of the upside, dependent on design.	• Government only pays when a project is producing and will pay less overtime because its dynamic in that it: • Considers a proponent's cost of production, which will reduce overtime with policy support and reduction of green premium • Creates a bankable revenue stream for projects looking to access capital – this especially helps smaller producers • Avoids companies using the subsidy to reduce tax liabilities of non-clean energy projects as its paid to a project rather than company tax • The government/taxpayers can share in the profits of the project if there is upside. • Other similar mechanisms are being used in Australian clean energy policy supporting ease of implementation[1]	• Higher government burden administrative costs for government to run tendering processes and contract management • Risk of inefficiency and market distortion if not kept at arm's length with rigorous governance procedures • Potential for collusion in submission of required strike-price[3]	**Case example: Australian renewable energy buildout** State governments throughout Australia have implemented contracts for difference schemes and auctions for different aspects of the renewable energy buildout, most recently the Federal Government has announced their use in the capacity investment mechanism.
Production tax credits	A credit linked to the production of a unit of a good in the prioritised industry, it is delivered as a deduction on a company's tax liability.	• Government only pays when a project is producing. • Provides a strong signal and level of confidence to business that all projects will receive the subsidy, supporting clarity in investment decisions. • Avoids high administrative burdens or potential for project selection distortion	• Blunt – doesn't consider proponents actual cost of production, providing the possibility of over-subsidisation / rent-seeking • Advantages players who have the required capital to develop a project and reach production, smaller players/Start-ups who find it harder to access capital may be at a disadvantage – annual delivery of the tax credit does not provide a bankable revenue stream to give confidence to lenders[2] • Potential for distortion if used by a company to lower the tax liability of non-clean energy projects in their portfolio[3]	**Case example: U.S IRA** in the IRA production tax credits are provided for advanced manufacturing (incl. batteries), green hydrogen and clean electricity. Credits are transferable meaning that owners of the credit can monetize it by transferring it to other tax entities for a cash payment. Tax exempt organisations are able to access the credit through direct pay.

Notes: 1. including the Hydrogen Headstart program and Capacity Investment Mechanism, 2. if production tax credits are used government should consider also implementing measures that increase access to capital for smaller players or allowing tax credits to be monetized (sold) in advance of the annual tax period to create bankable revenue streams. 3. Mechanisms to avoid this must be considered during detailed design. Sources: Low Carbon Contracts Company (2023), Canadian Climate Institute (2023), Herbert Smith Freehills (2023), ARENA (2023), Whitehouse (2022), Accenture analysis

Priority status in assessments & approvals for value-adding onshore

Description

Priority status in assessments & approvals should be provided for critical mineral and iron ore miners who are planning to either onshore value-add themselves or supply to onshore value-adders. This should include priority assessment for; Aboriginal Heritage assessments, environmental impact assessments, native vegetation clearing permit assessment, and any other key approvals deemed necessary during detailed design.

Priority assessments & approvals should be able to be obtained by miners who can prove their intent to value-add onshore either through their own integrated operations or agreements such as MoUs or contracts to sell their product onshore. The exact requirements to show sufficient intent should be decided during detailed design of the policy.

Case example: Chile – incentivising onshore value-add through preferential pricing
Chile is offering preferential prices on lithium carbonate for companies that setup value-adding lithium projects in the country.[1]

Rationale for mechanism selection

- Long assessment & approval times are a key challenge for many miners today, providing priority status in assessments & approvals to minimise lead times can incentivise miners to use or sell more of their product onshore.

Key design considerations

- Miners who receive priority status in assessments & approvalss will jump the queue in having their assessments & approval conducted – the assessment & approval itself however still must be completed to expected level of thoroughness.

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Critical minerals	• Lack of access to feedstock	Place critical minerals miners intending to supply to refiners onshore at the front of the queue.
Green iron	• Lack of access to feedstock	Place magnetite mines intending to supply to green iron and steel onshore at the front of the queue.

Notes: 1. Chile has plans to nationalize its lithium industry. 2. This policy has not been costed. Sources: Hook, L., Dempsey, H. & Nugent, C. (2023), Accenture analysis

Government procurement of batteries and steel

Description

Procurement requirements of a selected good for a government department/s to create domestic offtake and stimulate demand.

Case example: Australia – government EV fleets
As part of the National Electric Vehicles Strategy (2023), 50% of the the Australian Public Service passenger fleet will be electric by 2026 and 100% by 2030. Not only does this create stable demand it will also create demand at scale with aggregated purchases from government departments.

Case example: U.S – Build America, Buy America
The U.S regularly directs departments to buy domestically, this has been particularly apparent in Defence and Department of Energy. Furthermore, the Build America, Buy America Act requires that all of the iron, steel, manufactured products, and construction materials used in infrastructure projects are produced in the U.S.

Rationale for mechanism selection

- Government can be a large purchaser of manufactured products
- Government procurement provides certainty of demand in industries where a lack of domestic offtake is stifling offtake
- This is the case, to an extent in all the industries, however it was indicated by industry to be a stronger blocker in batteries, furthermore batteries the Defence industry is expected to have a sustained, reliable demand for batteries
- There is also stable demand of steel from public infrastructure projects
- Domestic procurement can in some instances reduce the net cost of procurement for government as additional tax revenues are collected through new work spurred by domestic procurement purchases

Key design considerations

- Ensure governance and planning is in place to avoid risk of procurement requirements causing delays or reductions in cost-benefits on government projects – this would require the ability to suspend the requirement where supply of the good is unavailable, delayed or will make the project uneconomic.
- Consider lifetime cost of procurement taking into account quality and use when comparing local and international content (i.e. whilst imports may have lower initial costs, in some cases domestic content will have a lower lifetime cost).
- Provide weighting to benefits from local procurement in tendering processes and cost-benefit analysis', state regulations can be used as reference during detailed design; for example, the Victorian Social Procurement Framework and the Local Jobs First Supplier Guidelines
- Projects meeting just transition, community benefit & First Nations engagement could be given preferred supplier status in procurement programs.
- For the steel procurement program - further detailed design is required as to how procurement funding is split between Federal and State funded public infrastructure projects

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Batteries	• Lack of domestic offtake	Develop a procurement program for the Defence industry. Based one expected demand for batteries from Defence and the cost differential between Australian batteries and lowest cost options[1].
Green steel	• Lack of domestic offtake	Provide funding for public infrastructure to substitute their current purchase of domestic steel to green steel as production capacity becomes available. The program is estimated based on the expected cost premium for green steel over brown and potential government procurement of green steel[1,2].

Notes: 1. See methodologies in appendix. 2. Cost premium for green steel ranges from 16-29% (Gates), it is assumed this will fall to price parity by 2035 (Woodmac), therefore per unit funding of government procurement will decrease. Public infrastructure projects procure ~3mt of steel on average where ~1.8mt of this is domestic. Its assumed 1% of this can be procured green by 2025 as Whyalla green steel ramps up. It's assumed that this ramps up to all being green by the end of the investment period. Source: Department of Climate Change, Energy, The Environment & Water (2023), Accenture (2023), Centre for Future Work (2020), Whitehouse (2022), John Curtin Research Centre (2022), Australian Steel Institute (n.d.), Accenture analysis.

Co-ordination of industrial precincts & workforce skills programs delivered through the Net Zero Authority (NZA)

Description

$83m of funding was provided in to 2022-23 budget to establish a Net Zero Authority (NZA) with the mandate to:

- Support workers in emissions-intensive sectors to access new employment, skills and support as the net zero transformation continues.
- Coordinate programs across government to support regions and communities to attract and take advantage of new clean energy industries and set those industries up for success.
- Help investors and companies to engage with net zero transformation opportunities.

Skills programs and the co-ordination of industrials precincts fall into this mandate. The NZA could be provided funding to develop and deliver these policies. This should include:

- Coordination and development, alongside unions and industry, of training, programs and resources required to grow the workforce to reduce delays in critical minerals, provide access to advanced technical skills in battery manufacturing and support knowledge transfers between steel & iron ore and LNG & hydrogen
- Support the development of industrial precincts by coordinating the co-location of businesses, supporting the development of shared infrastructure requirements and facilitating recycling and circular economy partnerships
- Connect businesses along the value-chain to support knowledge spillovers

Case example: European Union Just Transition Mechanism
The Just Transition Mechanism (JTM) was set up to address the social and economic effects of the clean energy transition. It aims to mobilise €65-75 billion between 2021-2027 available to EU member countries. The funds will be used to assist with economic diversification, environmental rehabilitation, re-skilling and job search aid for workers.

Case example: Kwinana Industries Council
The Kwinana Industries Council (KIC) is an industry association coordinating a cluster of different industries in the Kwinana region in Perth including cement, chemicals, manufacturing and mining. The KIC has been able to coordinate efforts on skills, shared use infrastructure and more recently energy requirements for decarbonisation

Rationale for mechanism selection

- Coordination of industrial precincts will support the clean export industries to achieve economies of scale through reduced cost of logistics, shared infrastructure and knowledge spillovers
- Lack of co-ordination and the need to achieve economies of scale for competitiveness was noted as a key long-term blocker

Key design considerations

- There are several industrial precinct bodies running in Australia which the NZA should coordinate with, these include: the Kwinana Industrial Council, Heavy Industry Low-carbon Transition Cooperative Research Centre and the Hunter Renewable Energy Industrial Precinct

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Cross-cutting	• Lack of coordination • Requirements for scale to achieve long term competitiveness	$5b of funding was recommended in the original Sunshot report through assessment of funding for similar mechanisms in peer countries.

Notes: 1. See methodologies in appendix. Sources: Department of Prime Minister and Cabinet (2023), European Commission (2021), Kwinana Industries Council (n.d), World Economic Forum (2023)

International co-operation

Description

Work towards removing trade barriers for clean exports in their import markets; most notably the 15% tariff that India has on batteries.
Encourage Lighthouse tenants to setup operations in Australia, transferring some of their capability and creating a source of domestic offtake.
Improve diplomatic communications.

Case example: Austrade's Global Business and Talent Acquisition Team
Austrade identifies and establishes relationships with key international businesses that could support Australian exports based on filling critical skills shortages and supply-chain gaps in the short term.

Case example: POSCO & Roy Hill partnership
South Korea's largest steelmaker POSCO is partnering with Roy Hill to produce green pellets in the Pilbara, combining their steel capability with Roy Hill's iron ore mining capability. The WA Government has supported land access for this partnership.

Rationale for mechanism selection

- Tariffs in India are causing a direct trade barrier for batteries
- A lack of domestic offtake and capability gaps are blocking the scale up of critical mineral refining, batteries and green iron,
- Lighthouse tenants could help kickstart the industry and develop Australia's own capability overtime (in conjunction with the Net Zero Authority administering programs and other policies to support Australia building its own capability from the ground up)

Key design considerations

- Ensure that any negotiations of trade agreements or attraction of Lighthouse tenants upholds Australian labour standards, protection of indigenous rights and environmental assessments & approvalss
- Partner with countries that are key sources of demand for Australia's green export goods to facilitate export off-takes
- Partner with countries that have technology and skills that would supplement Australia's in the short-term
- Monitor levels of FDI to ensure it is not crowding out potential domestic investment
- Establishment of industry led migration programs which prioritise permanent migration pathways and ensure transfer of knowledge to the domestic workforce and which uphold high standards for wages, employment conditions and occupational outcomes.

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Critical minerals	• Lack of domestic offtake • Lack of access to skills & capability	Encourage Lighthouse tenants to setup operations in Australia, transferring some of their capability and creating a source of domestic offtake for value-adding critical minerals and green pellets & iron producers. This would be in the form of a large international battery producer and steel producer.
Green iron & steel		
Batteries	• Trade barriers • Lack of domestic offtake • Lack of access to skills & capability	Encourage Lighthouse tenants to setup operations in Australia, transferring some of their capability and creating a source of domestic offtake for active materials and cell manufacturers. This would be a large-scale downstream battery customer. Work to reduce tariffs from battery import in India.

Notes: This policy has not been costed. Source: Austrade (2022, n.d.), Milne, P (2023), Accenture (2023), Accenture analysis

Robust, fair, timely & community driven assessments & approvals

Description

Well-resourced overarching national coordination and strategic regional plans that are translated and driven by place-based planning owned by communities, and informed and guided by nature is required to lead to fairer and more timely assessments & approvals. Where processes and projects are delivered with community and delivering nature benefits in transparent and understood processes, the resulting outcomes will be better and there will be less chance of delay.

This coordination should be directed towards both proponents and approval offices and should consider Aboriginal Heritage assessments, environmental impact assessments, native vegetation clearing permit assessment, and any other key approvals deemed necessary during detailed design. This policy mechanism should also focus on ensuring that proponents are receiving the right training and communications, to ensure they are planning appropriately upon submission and meeting environmental and regulatory expectations, and that approval offices are communicating efficiently and effectively.

Case example: Made in Canada Plan
One of the priorities in the Made in Canada plan is to expedite major project reviews, while maintaining strong regulatory standards. To increase efficiency, Canada has provided $1.3b to the Impact Assessment Agency of Canada, the Canada Energy Regulator and other federal departments to improve the efficiency of assessments for major projects. Canada has also supported Natural Resources Canada to directly assist developers in navigating regulatory processes ($10.6m), and support deeper engagement with Indigenous partners on major projects ($8.7m)

Case example: Danish Energy Agencies 'One-Stop-Shop'
The 'One-stop-shop' serves as a single national point of contact to create a streamlined, transparent, and centralised permitting process for Danish energy projects. This expediates assessments & approvals processes while ensuring that proponents are planning appropriately to meet all required environmental and regulatory requirements.

Key design considerations

- Ensure that any updates to improve regulatory efficiency are maintaining regulatory effectiveness as a priority, this includes:
  - **Ensure all projects are assessed through rigorous and independent EIAs[2]**.
  - **All projects should avoid harmful impacts to nature**, and where impacts are unavoidable, deliver sustainable and durable gains for nature. The mitigation hierarchy should be observed, with avoidance of harmful impacts the highest priority. Exemptions or lower standards for environmental protection should not be used as this undermines trust in the regulatory system.
  - **Ensure projects attain free, prior and informed consent of Traditional Custodians** to ensure that First Nations Peoples have a seat at the table during development and can benefit from developments on their Country
  - **Promote the highest standards of community participation and engagement across development, construction, operation and decommissioning of projects.** Where possible, projects should support local communities, services and jobs and provide benefits such as reliable, affordable energy. Fair compensation should be paid to affected communities.

Implementation parameters

Industry	challenge/s addressed	Implementation parameters
Critical minerals Green iron & steel Batteries Green hydrogen	• Assessment & approvals effectiveness & timeliness • Regulatory disincentives	Fund national coordination bodies for assessments & approvalss with strategic regional planning driven with community involvement. Increase information and data sharing across regulatory agencies. Increase training and communication for proponents to ensure quality in planning and submissions.

Notes: 1. See methodologies in appendix. Sources: World Economic Forum (2023), Government of Canada (2023), Accenture analysis

Strengthening and co-investing in Australia's R&D ecosystem

Description

Targeted support to various key actors within the Australian R&D ecosystem can enable pioneering research facilities to increase technology and process maturity for key decarbonisation technologies. In particular, support should ensure R&D projects facing longer time horizons receive sufficient support to reach commercialisation stage of the R&D lifecycle at speed in the absence of an abundance of patient capital.

A strong R&D ecosystem can enable Australia to develop its own IP as opposed to importing, such as for active materials and cell manufacturing for batteries which increases costs. R&D in alternative technologies and pathways can also help de-risk and diversify Australia's industries while minimising shocks of future technology disruptions, such as battery R&D of early-stage battery technologies like vanadium flow batteries as alternatives to lithium and nickel-based batteries.

Case example: Fraunhofer Battery Alliance The Fraunhofer Battery Alliance has 20 institutes that engage in research on batteries and other energy storage devices. Pilot plant and small-scale production of cells is available at some of the institutes. One of the Battery Alliance institutes is the Fraunhofer Research Institution for Battery Cell Production FFB, which attempts to accelerate innovation and commercialisation of battery production.

Case example: Heavy Industry Low Carbon Transition Cooperative Research Centre (HILT CRC) HILT collaborates across industry partners in steel, iron, alumina and cement and academia on heavy industry decarbonisation research. HILT is carrying out several projects to support study into green steel and hydrogen.

Rationale for mechanism selection

- Technical advancements are needed in green iron & steel and hydrogen to realise the high ambition targets
- Australian-owned IP can reduce the cost of production in battery manufacturing
- R&D in other technologies can minimise shocks of future technology disruptions

Key design considerations

- Include industry and academia in development and implementation, and existing industry research centers (e.g. HILT, MRIWA), especially cross-industry industry research centers for projects that will deliver shared outcomes to industrial clusters
- Ensure that agreements are in place to promote knowledge sharing whilst maintaining competition in industry

Implementation parameters

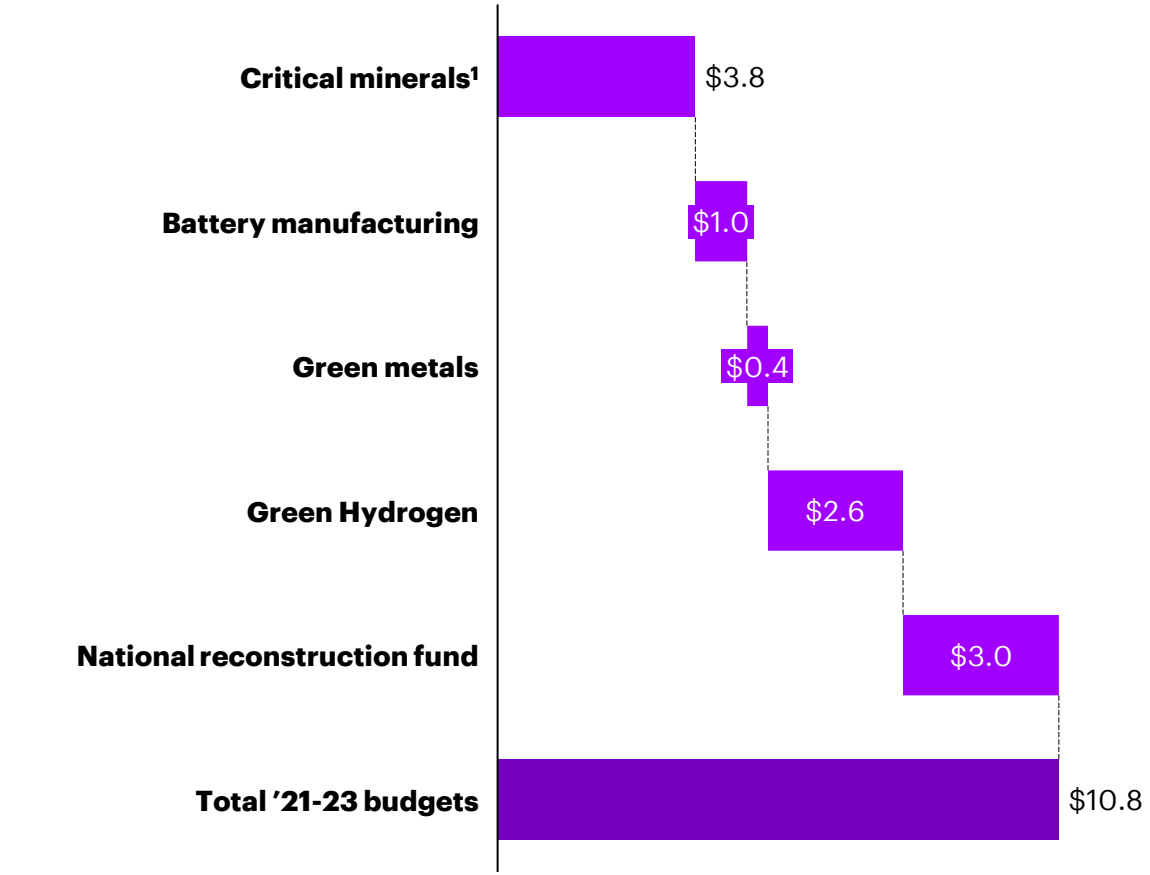
Industry	challenge/s addressed	Implementation parameters
Green iron & steel	• Technical challenges	Funding should support the development of a large-scale pilot facility for testing and production of green iron and steel through hematite ore pathways.
Batteries	• Technical challenges	Funding should be directed towards supporting the development of Australian-owned shared IP for cell manufacturing.
Green hydrogen	• Technical challenges	Funding should be directed towards facilities working to increases electrolyser efficiency.

Notes: 1. See methodologies in appendix. Source: HILT (n.d.), MRIWA (2023), Fraunhofer (2022), Accenture (2023), Accenture analysis

Pre-committed investments were considered in overall policy package design

Australia budget investment '21-23 on clean industry

$AUD Billion



Industry	2021-23 budget Policies
Critical minerals	• **Critical minerals facility loan** (EFA) $2b • **NRF** for critical minerals $1b • **NAIF** investments $0.5b • **Critical minerals accelerator initiative**[1]
Batteries	• **NRF** for advanced manufacturing delivered through co-investment & loans
Green iron & steel	• **Powering the regions fund** includes $0.4b to support sovereign manufacturing of steel & aluminium
Green hydrogen	• **Hydrogen headstart program** $2b to be delivered through competitive selection of projects for gov. to fund the cost gap • **Hydrogen hubs investment** $0.5b to support four regional H2 hubs • **Clean H2 trade program** $0.2 for supporting trade
Cross-cutting[2]	• **NRF for converting industrial facilities to renewables & low emissions technologies** investment in specific clean industry projects through co-investment & loans, includes consideration of converting facilities to low emissions (e.g. green metals)[2]

Notes: 1. ~$100m for international partnerships initiative and virtual national critical minerals R&D Centre also. 2. Available across multiple technologies and materials. Sources: Australian Government (March 2022, October 2022, May 2023),Accenture analysis

Appendix ii: Industry & policy sizing estimation methodology

Industry sizing modelling methodology and assumptions

	Method	Key Independent variable	Low Ambition	High ambition	Key sources
Critical minerals	Current revenue (DISR, Geoscience Australia) increases based on DISR forecasts and IEA growth rates in global demand. To meet this demand, Australia would need to increase onshore refinement, which we assume is 60% of mining output by 2040 under high ambition targets	Growth in global demand	To 2030: DISR To 2040: Stated policy scenario	To 2040: Net zero emissions scenario	DISR (2023), Resources Quarterly – March 2023 & June 2023 IEA (2023), Critical Minerals
		% of onshore refinement	20%	60%	
Batteries[1]	Increase in global revenue (Accenture) weighted by Australia's market shares (Accenture)	Australia's market share	AM = 3.0% CM = 1.5% BPM = 0.8%	AM = 6.2% CM = 1.7% BPM = 1.7%	Accenture (2023), Charging ahead
Green Metals	**Alumina & Aluminium:** Bauxite production projections (DISR) weighted by mount assumed to be converted into alumina refinement/aluminium smelting based on achievable capacity increases cited from stakeholder consultation.	% of alumina refinement % of aluminium smelting	Alumina: 2030, 2040 = 70% Aluminium: 2030, 2040 = 13%	Alumina: 2030, 2040 = 75% Aluminium: 2030, 2040 = 25%	DISR (2023), Resources Quarterly – March 2023
	Green iron: Iron ore production projections (DISR) weighted by amount assumed to be converted into green iron, assuming that Australia's metallurgical coal exports will be increasingly replaced with green iron – in a high ambition world we increase exports even further as its assumed our green iron trading partners grow beyond that of our current metallurgical coal partners[2] (achievable replacement rates cited from stakeholder consultation)	% of metallurgical coal to key importers replaced with green DRI	2030 = 11% (26mt) 2040 = 100% (244mt)	2030 = 16% (38mt) 2040 = 100% (268mt)	DISR (2023), Resources Quarterly – March 2023
	Steel: Iron ore production projections (DISR) weighted by amount assumed to be converted into green steel, based on achievable capacity increases cited from stakeholder consultation. Also considers Australia's current steel capacity and scrap steel all converting to green steel.	% of Australia's iron ore destined for export turned into green steel	2030 = 0.08% (0.5mt) 2040 = 0.13% (1mt)	2030 = 0.16% (2.6mt) 2040 = 2.29% (19.7mt)	DISR (2023), Resources Quarterly – March 2023
Green hydrogen[3]	Low Ambition: Assumes Australia will reach the same market share in green hydrogen as its current ammonia market share. Global green hydrogen market assumed to follow IEA trajectory. High ambition Target: AEMO NEM estimate adjusted to include WA, assuming WA proportion of hydrogen will follow their current shared of H_2 projects in pipeline.	Australia's market share Projected growth AEMO + WA	2030, 2040 = 1.63%	2030 = 1.1mt 2040 = 5.3mt 65% of Aus Forecasted Capacity in WA	IEA Draft 2023 ISP Inputs and Assumptions Workbook (2023), AEMO

Notes: 1. AM = Active materials, CM = Cell manufacturing, BPM = Battery Pack Manufacturing, 2. The role of green iron is expected to grow rapidly, reaching up to 702mt and accounting for more than 39% of primary steel production by 2040. Noting that projected proportion of green steel production using green iron varies up to 88% across different forecasts, such as McKinsey and Agora. 3. Assumption that ammonia will be the main carrier for green hydrogen and therefore green ammonia price was used. 3. Scope of key metallurgical coal importers here are China, Japan, South Korea and Taiwan to Source: IEA (2023), DISR (March 2023, June 2023), Geoscience Australia (2022), Accenture (2023), BNEF (2022), AEMO (2023), Mission Possible (2022)

Policy mechanism sizing methodology and assumptions

Policy Mechanism[1]	To 2030	To 2034	Industry	Delivery mechanism	Sizing methodology
Government procurement	$0.9	$2.5	Batteries	Funding provided to encourage gov. departments to procure desired product by covering the difference in cost for procuring the Australian green good vs what would have been procured otherwise.	**Difference in cost of Aust. batteries vs lowest cost internationally:** Australian batteries cost 19% more than the lowest cost producer (US) based on cost of production differentials, Applied to Australian battery demand for domestic buses and defence vehicles.
	$0.1	$0.2	Green steel[2]		**Difference in cost of green steel vs brown alternative:** Assumes 29% cost premium for green steel (falling to 1% by 2034) is funded by government for the amount of green steel procured. Assumes green steel as proportion of total public infrastructure steel procurement rises from 1% in 2025 to 73% in 2034.
Assessments & approvals	$1.3	$1.5	All	Funding provided to national, state and local bodies for better resourcing and coordination.	**Proportionate assessment of spend in peer countries:** Canada's Made-in-Canada provides $1.6b in funding to major project regulation agencies, Natural Resources Canada's Centre of Excellence on Critical Minerals, Crown-Indigenous Relations and Northern Affairs Canada. Funding also engagement with First Nations people and businesses for major projects. Funding has been weighted to Australia's GDP
Net Zero Authority: • Industrial precincts • Skills	$5.0	$5.0	All	Funding provided to Net Zero Authority to develop and co-ordinate shared infrastructure in industrial precincts and deliver skills programs	**Proportionate assessment of spend in peer countries:** $5 billion proposed in original Sunshot report for programmatic funding of the Net Zero Authority based on assessment of peer countries[3]
Strengthening and co-investing in Australia's R&D ecosystem	$1.4	$1.4	Green iron and steel	Co-investing in a commercial export-sized pilot green iron facility with insights on best practice production methods shared	**Co-investment for capital cost for green iron facility:** Assumes 50% private contribution based on assessment of other co-invested R&D facilities (e.g. MRIWA, HILT)
	$1.4	$2.2	Batteries and hydrogen	Funding provided to research institutions and early-stage technologies.	**Proportionate assessment of spend in peer countries:** Assessment of spend in peer country: Additional investment required to match Canada's R&D spending on clean energy technologies, weighted to Australian GDP.
Production and input incentives	$2.9	$7.9	Green hydrogen[4]	Funding provided to project proponents.	**Difference in cost of production compared to leading peers:** A$1.8 difference between Australia's current green hydrogen production cost and that of US producers with access to the full IRA production tax incentive, multiplied by forecasted production under the High Ambition scenario (assumes a decline in green premium/cost of production overtime).
	$4.7	$8.2	Green iron and steel[4]	Funding provided to project proponents.	**Difference in cost of production compared to leading peers:** A$1.9 difference between Australia's current green hydrogen production cost of hydrogen and cost required for green iron and steel producers, multiplied by forecasted green iron and steel production under the High Ambition scenario (assumes a decline in green premium/cost of production overtime).
	$2.1	$5.7	Critical minerals	Funding provided to project proponents.	**Difference in cost of production compared to leading peers:** 10% of cost of production incentive is required to keep investment onshore and be globally competitive considering Australian advantages and competitors estimated costs of production post policy support. multiplied by forecasted green iron and steel production under the High Ambition scenario (assumes a decline in green premium/cost of production overtime).
	$3.0	$3.0	Batteries	Funding provided to project proponents.	**Difference in cost of production compared to leading peers:** $35-45/kwh cost of production reduction is required to be globally competitive considering Australian advantages and competitors estimated costs of production post policy support. Costed to match Canada's level of ambition (uncapped would result in over $20b considering High ambition production). multiplied by forecasted green iron and steel production under the High Ambition scenario (assumes a decline in green premium/cost of production overtime).
	23b	**38b**			

Notes: 1. Prioritised assessments & approvals and international cooperation have not been sized for funding. 2. Green premium and decline as estimated by Gates, B & Woodmac, domestic steel procurement for public infrastructure projects as reported by Infrastructure Australia, 3. See further information in Sunshot, 4. Assumption that cost of green hydrogen reaches the US$1/kg required. Sources: Accenture (2023), Statista (2022), IEA (2023), Government of Canada (2023), World Bank (2023), Hannam, P. (2023), Accenture (2021), IEA (2023), MRIWA (2023), Longden et al. (2020), Gates, B (2021), Infrastructure Australia (2022), Woodmac (2022), Accenture analysis

Potential private investment catalysed methodology

Private investment catalysing methodology

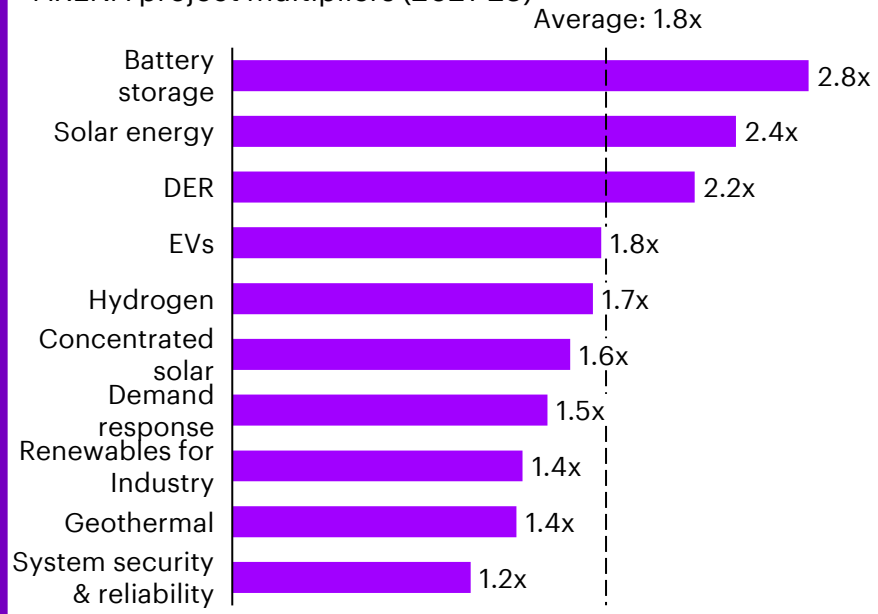
AUD Billion

	Mechanism	Total public investment	Total private investment	Methodology
Addressing short-term challenges	All	$4b	$12b	In clean energy in Australia, on average ARENA and CEFC have seen multipliers of 1.8-2.8x (2.8x used). This could be even higher – CEFC's multiplier in 2022-23 was 5x.
Building long-term capabilities	All	$9b	$24b	
Raising ambition to win	Critical minerals refining production incentive	$6b	$51b	Production incentive covers 10% of project costs, the other 90% will come from private investment, assumes investment follows what production targeted in the high ambition scenario.[1]
	Batteries production incentive	$3b	$9b	Production incentive covers ~26%[2] of project costs, the other ~74% will come from private investment, assumes investment follows what production targeted in the high ambition scenario.[1]
	Green hydrogen production incentive	$7.9b	$7b	Production incentive covers 55% of project costs, the other 45% will come from private investment, assumes investment follows what production targeted in the high ambition scenario.[1]
	Green iron & steel hydrogen input incentive	$8.2b	$8b	Production incentive covers 58% of project costs, the other 42% will come from private investment, assumes investment follows what production targeted in the high ambition scenario.[1]
		$38bn	**$109bn**	

CASE STUDY

ARENA & CEFC investment multiplier examples

ARENA project multipliers (2021-23)[3]



CEFC project multipliers

	'21-22	'22-23	Lifetime
CEFC commitments	$1.4b	$1.9b	$12.7b
Transaction value	$4.8b	$11.7b	$48.8b
Multipliers	2.3x	5x	2.8x

Notes: 1. note if dynamic mechanisms such as contracts for difference are used in the deployment of the incentive, the proportion of private investment to public investment would be expected to increase. 2. incentive ranges for active materials, cell manufacturing and battery pack manufacturing, average taken. 3. note ARENA's average excludes hydropower which included an outlier with a multiplier of over 14x (Kidston Pumped hydro project). Average would be 2.13x with hydro included. Source: Source: Credit Suisse (2023), ARENA (2023), CEFC (2023), Accenture analysis

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