A GREEN STEEL AND CLEAN ENERGY LEADERSHIP CASE STUDY

SOUTH AUSTRALIA

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Executive Summary

Exporting green iron instead of iron ore and coal could see Australia position itself as a leader in green iron and steel production, as well as deliver benefits including regional employment opportunities and economic diversification. This scenario is described in WWF-Australia's report – *Australia's Green Iron Key: Unlocking Asian Steel Decarbonisation, Securing Australia's Economic Future*. However, Australia cannot capitalise on our significant advantages of iron ore resources and potential for renewable energy generation without focused efforts. Development of low-emission hydrogen production is also a must for the leading iron and steel-making technologies available now to lower the industry's emissions.

In 2023, WWF-Australia embarked on a national green iron and steel fact-finding mission seeking answers to the question, "What is Australia doing that demonstrates the direction, ambition and coordination action required to create enablers for a green iron and steel industry?"

A deep dive into the policy and program portfolio of Australian states and territories showed that South Australia stands out in its leadership, ambition and action in developing a green iron and steel industry, and the upstream enablers of industrial-scale renewable energy and renewable hydrogen.

This case study identifies the key levers that have positioned South Australia at the forefront of Australia's green iron and steel industry development. It describes the South Australian Government's legislative and policy landscape, its funding programs and investments. It also considers the investment attraction activities underway to leverage these activities to attract foreign direct investment in new, low carbon economy projects.

The strategic themes that emerged have been consistent across the technology types and innovation developments over the past two decades: strong narratives embedded in economic policy; timely and ambitious policy, regulation and legislation; de-risking investment through offtake agreements; direct investment and market participation; and industry and meaningful community engagement.

This drive and determination partly has its genesis in the state's historic vulnerability to global market dynamics[1] and lack of significant quantities of export-grade commodities such as coal, iron ore or LNG. However, the state's response to its unique circumstances, both recognising the threat of climate change and identifying the economic potential of its world-leading solar and wind resources, was not a foregone conclusion: successive

[1] For example, key agricultural commodities have been vulnerable to global supply and demand fluctuations, while the automotive industry which was once a key contributor to the economy was impacted by the global shift to more competitive manufacturing in Asia.

South Australian governments have consistently embedded the low carbon economy narrative in the state's economic direction and ambition.

South Australian governments have historically taken, and continue to take, a market participation approach, either de-risking investment through offtake agreements or directly investing in core infrastructure.

Effective communication and strong working relationships, both internal and external to government, have been instrumental in the success of successive policies and programs.

As Australia grapples with the imperative to fast-track its transformation to a low carbon economy, the South Australian approach can provide a template for driving, enabling and de-risking large-scale infrastructure investments as part of a program of low carbon economic transformation that should be considered by state, territory and federal governments across a range of sectors.

1. Introduction

Leveraging its competitive advantage of a world-leading combination of solar and wind resources and building on its legacy of climate change and clean energy[1] leadership, South Australia has now positioned itself to be a leader in the race to attract international investment in renewable energy, green hydrogen and low carbon export industries such as green iron and steel. The positive consequences of South Australia's leadership have been demonstrated through a collaborative study by the Port of Rotterdam and Monash University, which shows South Australia's green iron would have a 21% advantage when compared with shipping its raw components to Europe[2].

South Australia has consistently led the nation in recognising and embracing the economic opportunity that competitive electricity prices, driven by renewable energy firmed with batteries, can unlock for prospective global investors in new metals, minerals and manufacturing opportunities.

Starting with the Rann Labor Government in 2004, which set a target of 15% renewable energy generation by 2014 and 26% by 2020, successive South Australian governments have created an enabling environment for clean energy investment.

The state's investment attraction policies and programs have attracted more than $6 billion[3] of investment in large-scale renewable energy and storage projects to date, with approximately $21 billion in the investment pipeline. A further $150 billion potential investment in renewable energy generation and hydrogen electrolyser capacity has been identified[4].

This economic transformation has been founded on acute climate change awareness, action and leadership. South Australia was the first Australian state to legislate targets to reduce greenhouse gas emissions through the introduction of the *Climate Change and Greenhouse Emissions Reduction Act 2007* and continues to play a leadership role in climate change policy, having declared a climate emergency in May 2022.

There are many examples of the South Australian leadership model across small- and large-scale renewable energy development, battery energy storage, renewable hydrogen and green iron and steel, with the state often opting to play an active role and participate in relevant markets. South Australia has consistently de-risked investment in low carbon economy industries by creating enabling policy and regulatory settings, providing grant

[1] In this report, 'clean energy' refers to renewable energy, battery energy storage and renewable hydrogen. It does not include fossil gas, or 'blue' hydrogen.

[2] "South Australia - NW Europe via Rotterdam Supply Chain Case Study" (Government of South Australia and Port of Rotterdam, February 2024), https://www.energymining.sa.gov.au/__data/assets/pdf_file/0003/1006986/3f3eb52597c8bc4c4cbe0295a0b1647d7a5660e0.pdf.

[3] All dollars are Australian dollars.

[4] "Invest South Australia, 'Building Global Partnerships in Renewables and Hydrogen Brochure', 2024. https://invest.sa.gov.au/sectors/minerals-and-energy

funding or investing directly, working closely with industry and, in some cases, underwriting investment through the provision of state government offtake agreements.

Drawing on desktop research and stakeholder interviews, this case study explores the key components of South Australia's industrial-scale clean energy, green hydrogen and green iron and steel industry development leadership, describing the legislative and policy landscape, funding programs and investments and identifying the key levers that have positioned South Australia at the forefront of Australia's low carbon economic transition. In doing so, it highlights the advantages that jurisdictions can attain through proactive and foresighted policy and financial commitment.

2. South Australia's economic context and clean energy history

South Australia's drive to realise its clean energy and export opportunities reflects a combination of its historical context and current circumstances.

While introducing many worthwhile and significant policies and programs, other states and territories seem not to have the same hunger for clean energy and export investment as South Australia, which has actively sought opportunities for low carbon economic growth, particularly in renewable energy, since the early 2000s.

While this is partially explained by the state's world-class combination of solar and wind resources, it has also been a response to significant and rapid declines in vulnerable economic sectors, such as car manufacturing, coal-fired power generation and coal-based steel production. Realising its comparative advantages in renewable energy and pre-existing infrastructure has driven South Australia's pivot to innovation and sustainability, propelling economic growth in emerging sectors and alignment with global efforts to transition to a zero-emissions economy.

Recognising the potential for industrial-scale wind from the early 2000s and having suitable resources and electricity infrastructure, South Australia proactively developed planning frameworks to attract investment in wind farms[5] [6]. Other factors, such as South Australia's higher electricity prices in the early days of the National Electricity Market (NEM), coupled with government incentives, drove strong uptake of rooftop solar PV, which contributed significantly to the high penetration of renewable energy in the state's electricity network[7].

A key turning point in South Australia's energy transition was the period in which the 2016 closure of the state's last coal-fired power station was closely followed by a state-wide blackout, triggered by severe weather that damaged transmission and distribution assets.

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[5] "Select Committee on Wind Turbines, August 2015," accessed March 1, 2024, https://www.aph.gov.au/parliamentary_business/committees/senate/wind_turbines/wind_turbines/~/media/Committees/wind_ctte/Final_Report/report.pdf.

[6] "Inquiry into South Australia's Renewable Energy Competitiveness" (South Australian Productivity Commission, August 10, 2022), https://www.sapc.sa.gov.au/__data/assets/pdf_file/0007/847348/Renewable-Energy-Competitiveness-Final-Report-Website-Version.pdf.

[7] "South Australian Electricity Report" (Australian Energy Market Operator, November 2023), https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/sa_advisory/2023/2023-south-australian-electricity-report.pdf?la=en.

The extensive blackout event, estimated to have cost South Australian businesses $360 million[8] and incorrectly attributed by some commentators to the state's high penetration of renewable energy[9], prompted significant government intervention in the energy market. In 2017, the South Australian Government, led by Premier Jay Weatherill, commissioned the 100MW[10] battery – the Hornsdale Power Reserve grid-scale battery (at that time the world's first and largest grid-connected battery), delivered by Tesla and Neoen, and established a renewable technology fund, signalling a deep public commitment to a clean energy transformation.

Concurrently, South Australia was grappling with the decline of its automotive industry, marked by the closure of major car manufacturing plants. In response, the government implemented industry programs aimed at modernising affected areas and positioning the state as a high-tech innovation hub.

Despite a change in state government in 2018, the momentum towards renewable energy continued unabated due to its clear economic benefits and the lack of viable alternatives. The 2019 *Hydrogen Action Plan* signalled bipartisan recognition that renewable energy had a permanent place in the state's economic policy.

South Australia's 2022 Economic Statement[11] harks back to these multiple historical drivers of the current ambitious push towards a clean export economy: *"Of course, South Australia's strength and potential in renewable energy is not new. It exists because we saw the potential competitive advantage in the early days of renewable energy in Australia and actively supported its development. This was despite what many saw as the risks of adopting a different path..... Our state's record also evidences a willingness for government to be an active partner in economic development. Many of the legacies we still benefit from today are the result of policies and investments in years past. We need to work collaboratively with industry—existing and emerging—to enable the next transformation of our economy."*

The South Australian Government signalled strong intent to continue its industry development approach in the low carbon economy, with the Economic Statement going on to note:

"As we embark on the next economic transition, one driven by sustainability and technology, the government will again step in with selective interventions and policies to support industry development, productivity and competitiveness...This mission goes

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[8] "Power Cuts Have Hit SA in a Big Way — Here's How They Compare to the 2016 Statewide Blackout," *ABC News*, November 14, 2022, https://www.abc.net.au/news/2022-11-14/sa-blackouts-compared-to-2016-electricity-cut/101649566.

[9] Adam Lucas, "Confected Conflict in the Wake of the South Australian Blackout: Diversionary Strategies and Policy Failure in Australia's Energy Sector," *Energy Research & Social Science* 29 (July 1, 2017): 149–59, https://doi.org/10.1016/j.erss.2017.05.015.

[10] An additional 50MW was added in 2022.

[11] "South Australian Economic Statement," Premier of South Australia, March 29, 2023, South Australia, https://www.premier.sa.gov.au/south-australian-economic-statement.

beyond reducing emissions. The aim is to leverage the green transition to reorient the state's economy to future global demand. We can lead in green industries, as well as greening supply chains across sectors and moving up the value chain. Competitiveness in sustainability will provide South Australia a new advantage."[12]

Uniquely among states and territories, South Australia is developing a Green Industrial Transition Roadmap to *"provide a vision for how South Australia can build sustainable industries in sectors that best leverage our high penetration of renewable energy and natural endowments to build new, low carbon value chains, and transition existing high emitting industries"*[13].

3. Creating the foundations for the low carbon economy: Climate change policy

South Australia's position as the Australian leader in the low carbon economy transformation reflects its early mover status in acknowledging and responding to the threat of climate change. The introduction of the *Climate Change and Greenhouse Emissions Reduction Act 2007* was the first climate change legislation to be introduced in Australia, and only the third of its kind in the world.

On 31 May 2022, the Government of South Australia was the first Parliament in Australia to declare a climate emergency. The debate in the House of Assembly was notable in that there was bipartisan support for the intent of the motion.

South Australia's renewable energy and related aspirations and bipartisan positioning[14] have been driven, in part, by the impacts of climate change on its environment and economy[15].

4. Renewable energy and green hydrogen

South Australia's competitive advantage of world-class solar and wind resources, combined with its comparatively accessible transmission infrastructure (which reduces grid connection costs for new renewable generation), has long been recognised[16]. In more recent years, the role of industrial-scale renewable energy in lowering power prices to provide low-cost energy, which in turn attracts energy-intensive industries such as aluminium refining, green iron and steel and advanced manufacturing, has been front and centre of the state's economic agenda.

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[12] "South Australian Economic Statement."

[13] "Industrial Transformation," Department for Industry, Innovation and Science, 2024, https://industry.sa.gov.au/industrial-transformation.

[14] "Hansard Daily: House of Assembly - Tuesday, May 31, 2022," accessed January 17, 2024, https://hansardsearch.parliament.sa.gov.au/daily/lh/2022-05-31/33?sid=f1e449e8277b4b8abc.

[15] Dr Michael McGreevy et al., "Expediting a Renewable Energy Transition in a Privatised Market via Public Policy: The Case of South Australia 2004-18," *Energy Policy* 148 (January 1, 2021): 111940, https://doi.org/10.1016/j.enpol.2020.111940.

[16] "Renewable Energy Competitiveness Final Report," accessed February 18, 2024, https://www.sapc.sa.gov.au/__data/assets/pdf_file/0007/847348/Renewable-Energy-Competitiveness-Final-Report-Website-Version.pdf.

As South Australia's 2022 Economic Statement notes, *"Our renewable energy capacity and world-leading investment in hydrogen production also provide a new opportunity—a green reindustrialisation of our economy. Building on our industrial capability, we have the potential to manufacture and export premium products like green iron and green processed critical minerals, underpinned by world-class carbon accounting and greater circularity of resources."*[17]

4.1 Renewable energy

In 2002, South Australia had no renewable energy production and imported around 30% of its electricity requirements from interstate coal-fired power stations. It has transformed its electricity system from 1% to more than 70% renewable energy in just over 20 years[18]. South Australia's first renewable energy targets of 15% renewable energy generation by 2014 and 26% by 2020 were introduced in 2004 following the election of the Labor Government in 2002. The government subsequently announced targets of 33% renewable energy by 2020 (in 2011) and 50% by 2025 (in 2014).

In 2020, the then-Liberal Government set the target of 100% net renewables by 2030[19].

In February 2024, the current state government set a new target to achieve 100% net renewables[20] by 2027. South Australia's transmission company ElectraNet has forecast that this target will be met[21].

South Australia benefited greatly from the Australian Government's initial 9,500GWh per year Mandatory Renewable Energy Target (MRET) and its subsequent increase to 41,000GWh per year for large-scale generation certificates (RET). Coupled with its above-average wind speeds and higher power prices, some argued that South Australia's renewable energy success was less a result of state-based targets and more a natural outcome of the combination of these factors[22].

While the renewable resource itself was, and remains, the key investment driver, other enabling policies and programs positioned South Australia as a more competitive investment destination than other Australian jurisdictions. In the early to mid-2000s, the South Australian Government complemented its comparative advantages with a regime of

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[17] "South Australian Economic Statement."

[18] South Australia's Green Paper on the Energy Transition, 2023, https://www.energymining.sa.gov.au/public-consultations/south-australias-green-paper-on-the-energy-transition

[19] *Ibid*

[20] "Net" 100% renewables means that the state will export surplus production when needed, and import when needed (https://reneweconomy.com.au/south-australia-to-reach-100-pct-wind-and-solar-within-a-few-years-says-network-company/)

[21] Unlocking Renewables to Meet South Australia's Growing Electricity demand https://www.electranet.com.au/unlocking-renewables-to-meet-south-australias-growing-electricity-demand/

[22] Tristan Edis, "South Australia's 'do Nothing' Renewables Target," *The Australian*, September 24, 2014, sec. Business Spectator, https://www.theaustralian.com.au/business/business-spectator/south-australias-do-nothing-renewables-target/news-story/fe3c328d7fb2bb64455a334b2965fe62.

consistent and coordinated energy policy, noise and planning guidelines and government offtake agreements[23] [24].

While Labor Governments have dominated South Australia's political landscape, bipartisan support for renewable energy development has played a role in this globally recognised success story. Despite significant controversy between 2014 and 2018, with South Australia's high penetration of renewable electricity being incorrectly cited as the reason for high electricity prices and state-wide blackouts[25], a commitment to renewable energy became a bipartisan position.

In 2017-18, in addition to the procurement of the 100MW[26] Hornsdale Power Reserve grid-scale battery (at that time the world's first and largest grid-connected battery), the state government allocated $150 million to a Renewable Energy Fund to provide loans and grants to eligible projects (including hydrogen storage)[27]. This significant investment from government in the energy market demonstrated the government's vision and willingness to drive innovative solutions, along with the associated technology, commercial and reputational risks.

According to ElectraNet, South Australia has regularly experienced 100% or more instantaneous variable renewable energy generation since October 2021 [28]. This level of renewable energy in the power system creates significant variability in the generation profile, which presents new challenges to power system security. Significant power system investments have occurred and are underway to ensure the reliability and power quality of the electricity network[29].

While South Australia's renewable energy achievements are impressive, the transformation to a low carbon economy, including renewable hydrogen and green iron and steel production, requires significantly greater levels of renewable energy investment.

AEMO's 2022 Integrated System Plan (ISP) indicated that the National Electricity Market annual electricity demand could grow very strongly from 10,000GWh pa in 2021-22 to up to

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[23] McGreevy et al., "Expediting a Renewable Energy Transition in a Privatised Market via Public Policy."

[24] "South Australian Desalination Renewable Energy Contract Underlines Strength of AGL's Renewable Energy Position," accessed February 16, 2024, https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2009/september/south-australian-desalination-renewable-energy-contract-underlines-strength-of-agls-position.

[25] Premier of South Australia, "Landmark Hydrogen and Renewable Energy Bill Passes State Parliament," Text, Premier of South Australia, November 16, 2023, South Australia, https://www.premier.sa.gov.au/media-releases/news-items/landmark-hydrogen-and-renewable-energy-bill-passes-state-parliament.

[26] An additional 50MW was added in 2022

[27] "A Hydrogen Roadmap for South Australia" (Government of South Australia, 2017), https://www.energymining.sa.gov.au/industry/modern-energy/hydrogen-in-south-australia/hydrogen-files/hydrogen-roadmap-11-sept-2017.pdf.

[28] "Transmission Annual Planning Report" (ElectraNet, October 2023), https://www.electranet.com.au/what-we-do/network/transmission-annual-planning-reports/. page 1

[29] These are not South Australian Government investments, but are made by the transmission service provider, ElectraNet, and recovered through regulated tariffs.

50,000GWh pa by the early 2030s under a "Green Export" scenario[30]. In the 2024 ISP, AEMO declared ElectraNet's proposed 'renewable energy network' to the Upper Spencer Gulf, the Mid North South Australia REZ Expansion, an 'actionable project', suggesting confidence that greater transmission capacity will be needed to distribute new renewable energy supplies[31].

According to the South Australian Government, there are around 56 renewable energy projects worth more than $20 billion in the development pipeline[32]. Privately owned transmission network service provider, ElectraNet's *Transmission Annual Planning Report 2023* reported that more than 2GW of new demand was seeking connection to the network, which would require around 6GW of new renewable generation capacity and that it had received enquiries for eight proposed large-scale generation projects each of more than 1GW in size[33].

Stakeholder engagement

According to South Australia's Department of Trade and Investment (DTI), 97% of South Australians desire renewables as their main source of energy[34]. While there is broad support for South Australia's energy transition, stakeholders acknowledge concerns, particularly in ecologically sensitive areas like the Flinders Ranges.

Stakeholders noted that to address these challenges, early and inclusive conversations are crucial. The South Australian Government's approach involves proactive engagement with Traditional Owners and Native Title holders through forums like the South Australian Aboriginal Renewable Energy Forum (SAAREF). These discussions allow stakeholders to express their concerns, aspirations, and expectations regarding renewable energy projects on Country. This collaborative approach not only ensures better decision-making but also fosters mutual understanding and respect between the state government, industry, and Indigenous communities. The success of the SAAREF engagement model was such that it is being applied to other major projects across South Australia.

4.2 Green hydrogen

The state's renewable energy and renewable hydrogen aspirations are inextricably entwined: not only are vast amounts of renewable energy required for renewable hydrogen

[30] "South Australia Sees 'Doubling in Demand' for Its Low-Cost Green Electricity | RenewEconomy," accessed January 19, 2024, https://reneweconomy.com.au/south-australia-sees-doubling-in-demand-for-its-low-cost-green-electricity/.

[31] "2024 Integrated System Plan (ISP)" (Australian Energy Market Operator (AEMO), June 26, 2024), https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp.

[32] "South Australia A Global Force in Renewable and Hydrogen Energy. Dept of Energy and Mines, 2023," accessed February 19, 2024, https://www.energymining.sa.gov.au/__data/assets/pdf_file/0006/891888/205715_SA_A_global_force_brochure_WEB.pdf.

[33] "Transmission Annual Planning Report."

[34] "Hydrogen in South Australia | Department for Trade and Investment," accessed February 18, 2024, https://invest.sa.gov.au/hydrogen.

production, but hydrogen projects also have the potential to address some of the emerging electricity system challenges.

South Australia was the first Australian jurisdiction to develop a hydrogen development plan, with the release of the *Hydrogen Roadmap for South Australia* in 2017. The Roadmap set out a "vision to accelerate South Australia's transition to an Asia-Pacific hub for the production, use and export of hydrogen as part of a safe, clean and sustainable economy"[35] and set a target of $10 billion investment in low carbon energy by 2025.

Following the Council of Australian Governments Energy Council's 2018 decision to develop a National Hydrogen Strategy for 2020-2030, the then-state Liberal Government released *South Australia's Hydrogen Action Plan*[36] in 2019.

Between 2017 and 2019 the South Australian Government committed more than AU$17 million in grants and $25 million in loans to four local hydrogen production proposals (noting not all of these were renewable hydrogen projects)[37]. The Australian Government has committed $70 million in matched funding, with $30 million from the South Australian Government and $40 million expected to be contributed by project partner developers to enable the export of hydrogen from the Port Bonython Jetty and early investigations into other potential common user infrastructure[38] (see Figure 1).

[35] "A Hydrogen Roadmap for South Australia."

[36] While this Action Plan acknowledged and promoted South Australia's potential for renewable hydrogen production, they were not exclusively focused on renewable hydrogen.

[37] "South Australia's Hydrogen Action Plan," Finlaysons Lawyers, September 25, 2019, https://www.finlaysons.com.au/2019/09/launch-of-south-australias-hydrogen-action-plan/.

[38] Office of Hydrogen Power South Australia.

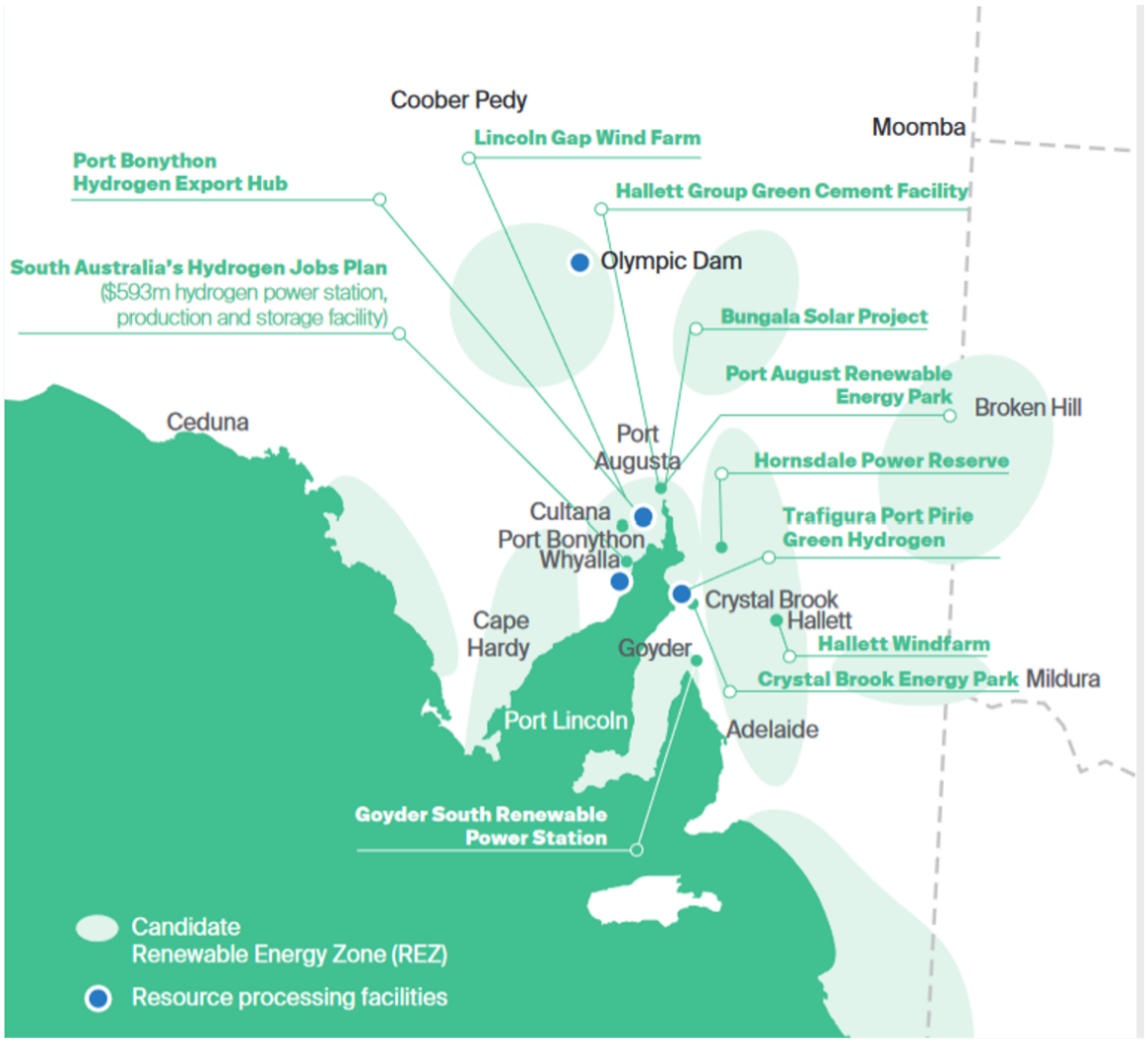

Figure 1: An overview of South Australia's proposed renewable energy and hydrogen infrastructure (Source: South Australia, A Global Force, Department of Energy and Mining (February 2023)).

The South Australian Government's renewable hydrogen agenda was detailed in the Labor Party's election platform for the 2022 state election under the banner of the 'Hydrogen Jobs Plan', which included commitments to:

- build 250MW of hydrogen electrolysers and a 200MW hydrogen power station in the Whyalla area by December 2025, and
- establish an office of 'Hydrogen Power SA' to:
    - own and operate the hydrogen production and power plant as a government enterprise
    - rejuvenate manufacturing in South Australia by utilising hydrogen and the associated electricity generated to grow job-creating industries in South Australia and
    - establish a world-leading hydrogen industry, including hydrogen export[39].

[39] "Hydrogen Jobs Plan" (South Australian Labor, 2022), https://sa.alp.org.au/wp-content/uploads/2023/07/Hydrogen-Jobs-Plan.pdf.

Hydrogen Jobs Plan infrastructure

The purpose of the government-funded electrolyser, renewable hydrogen power station and storage project is to accelerate the growth of South Australia's hydrogen economy, create market demand for renewable hydrogen, and create a gigawatts-scale pipeline of renewable energy developments across the state[40].

In October 2023, a consortium comprising ATCO Australia and BOC-Linde was announced as the preferred hydrogen delivery partner for the electrolysers and power plant, with EPIC Energy chosen to develop an integrated pipeline and hydrogen storage solution[41].

Similar to the Hornsdale battery project, the Hydrogen Jobs Plan demonstrates a commitment to innovation and a willingness to take risks and to directly participate in the energy market. Since the South Australian Government's 2017 investment in the Hornsdale battery project, $1.5 billion of private sector capital has been invested in an additional five grid-scale batteries, with no government financial support[42]. The Hydrogen Jobs Plan is expected to have a similar investment impact, demonstrating that the government has its own 'skin in the game' and highlighting the wind and solar capacity factor opportunities for subsequent electrolyser investments. The approximately $600 million funding to de-risk future investment is seen as a better incentive than allocating grants on a project-by-project basis[43].

South Australia's investments send a signal to renewable energy and clean export industry investors that the state is serious about creating infrastructure investment opportunities, as well as markets for renewable energy and hydrogen-related equipment, technology and services industries.

Hydrogen Export Strategy

South Australia's commitment to developing a hydrogen export strategy recognises that its green hydrogen opportunities will lie primarily in the export sector due to its smaller industrial base relative to other potential green hydrogen producers.

The potential economic impacts of a hydrogen export industry are large. In its *Inquiry into the Competitiveness of Renewable Energy*, the South Australian Productivity Commission noted that modelling of the impacts of a plant with a 1,500MW electrolyser, suggesting that

[40] "South Australia A Global Force in Renewable and Hydrogen Energy. Dept of Energy and Mines, 2023."

[41] "Preferred Partners Chosen for Whyalla Hydrogen Jobs Plan | Mirage News," accessed March 1, 2024, https://www.miragenews.com/preferred-partners-chosen-for-whyalla-hydrogen-1108516/.

[42] Stakeholder interview

[43] Stakeholder interview

it would increase Growth State Product (GSP) by 1.4% or $1.9 billion, increase exports by $0.9 billion and create 4,600 jobs (equivalent to 40% of Whyalla's current employment)[44].

The Port Bonython Hydrogen Hub

The South Australian Government is also leading a consortia of industry partners committed to the development of a multi-user export precinct, including South Australia's first large-scale hydrogen export terminal, as part of a Hydrogen Hub development at Port Bonython[45].

Port Bonython is located 16km from Whyalla in the Upper Spencer Gulf and has an existing deep-water export terminal. State and federal governments have committed $100 million, and industry has committed $40 million, to developing common user infrastructure, such as upgrades to the port, common-user last mile pipelines, storage and access roads to realise the vision of creating South Australia's first large-scale clean hydrogen production precinct.

Development agreements have been negotiated with five developers to provide a clear pathway for developers to secure a long-term lease on land at Port Bonython while feasibility studies and early design works for their proposed hydrogen projects continue. Three of the developers – Amp Energy, Fortescue Energy and H2U – are collaborating with the Office of Hydrogen Power SA to deliver common user infrastructure and plans at the hub and to advance critical environmental assessments[46].

Office of Hydrogen Power SA

Originally established in May 2022 to oversee delivery of the Hydrogen Jobs Plan, the Office of Hydrogen Power South Australia (OHPSA) now has a broader remit and plays a key role in attempting to foster growth in South Australia's hydrogen industry.

Administratively located with the South Australian Department of Energy and Mining and reporting directly to the Premier, OHPSA's role includes:

- Construction of the 250MW hydrogen production facility, 200MW hydrogen power plant, and hydrogen storage infrastructure in the Whyalla area by December 2025.
- Development of the Hydrogen Export Strategy.

[44] "Renewable Energy Competitiveness Final Report."

[45] "South Australia A Global Force in Renewable and Hydrogen Energy. Dept of Energy and Mines, 2023."

[46] Office of Hydrogen Power South Australia, Development Agreements, https://www.hydrogen.sa.gov.au/projects/port-bonython-hydrogen-hub/project-partners

- Facilitating the design of the multi-party Port Bonython Hydrogen export hub with private sector project partners[47].

In performing these roles, OHPSA has identified opportunities and barriers to government and industry project pipelines, providing insights to inform government decisions and strategies.

OHPSA leads South Australia's engagement in the National Hydrogen Strategy, manages legislative responsibilities related to project delivery and engages with stakeholders across the sector, including project developers, equipment manufacturers, and industry bodies. OHPSA was originally expected to transition to become a Government Trading Enterprise to manage the hydrogen assets in the energy market. However, the exact future commercial structure is yet to be determined by the state government[48].

Stakeholder engagement

Key OHPSA deliverables, the Hydrogen Jobs Plan and the Port Bonython Hydrogen Hub are both located in the Upper Spencer Gulf. Effective engagement with a diverse range of stakeholders is critical to the successful delivery of OHPSA's goals.

A *Hydrogen Industry in the Upper Spencer Gulf Working Group* and *Hydrogen and Upper Spencer Gulf Chief Executive Reference Group* have been established, enabling cross-state government collaboration to support progress on delivering the Upper Spencer Gulf initiatives[49].

Recognising that these projects impact First Nations country and acknowledging the essential role that Indigenous people play in South Australia's emerging hydrogen industry as land managers, heritage custodians, business owners and community leaders, OHPSA reported in its 2022-23 Annual Report that it *"meets regularly with the Barngarla People as the Traditional Owners of the land in and around Whyalla"* and that OHPSA's Chief Executive, Sam Crofter, has been closely involved in the South Australian Aboriginal Renewable Energy Forums[50].

Hydrogen and Renewable Energy Act 2023

Between 2002 and 2022, South Australia achieved a significant level of renewable energy generation through projects situated on freehold land in the state's mid-north. However, extensive expansion of renewable generation projects, particularly into state government-

[47] "OHPSA Annual Report 2022-23," Text, Energy & Mining, December 1, 2023, South Australia, https://www.energymining.sa.gov.au/about/annual-reports/ohpsa-annual-report-2022-23.

[48] Stakeholder interview

[49] "OHPSA Annual Report 2022-23."

[50] "OHPSA Annual Report 2022-23."

owned pastoral land, which covers about 40% of the state, is needed to support the state's ambitions in the hydrogen sector[51].

Land access provisions under state and federal legislation previously required complex interactions with multiple regulators[52] and operated on a first-come, first-served basis. A shift to a planned and regulated approach that *"supports the delivery of state strategic priorities and the greatest benefits for all South Australians and the environment"* was seen as both desirable and necessary[53].

South Australia's Department of Energy and Mining was tasked with combining six pieces of legislation into the new *Hydrogen and Renewable Energy Act 2023* (the HRE Act), which was passed in November 2023[54]. The Act will become operational once the associated regulations are established.

The HRE Act creates a competitive tender process for designated land, such as pastoral land and State waters, and designates consultation, environmental standards and land rehabilitation requirements. It applies a 'one window to government' approach that had already been used for mining activities under the *Mining Act 1971* and energy resource activities under the *Petroleum and Geothermal Energy Act 2000*.

The competitive assessment criteria will incorporate various constraints, including environment and Indigenous heritage, to ensure that potential sites are carefully vetted before designation for renewable energy projects.

In addition to licencing and regulating renewable energy projects and hydrogen production over the project lifecycle, including decommissioning, the HRE Act incorporates modern principles such as circular economy concepts and emphasises First Nations engagement from the outset, recognising their participation in decision-making as central to South Australia's clean energy future.

Hydrogen Workforce Plan

To ensure sufficient workforce capability and position communities to benefit from the emerging green hydrogen sector, the South Australian Government, across the Department for State Development, DEM and OHPSA is developing a Hydrogen Workforce Plan[55].

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[51] "Hydrogen and Renewable Energy Act Issues Paper" (Government of South Australia, Department of for Energy and Mining, 2022), https://www.energymining.sa.gov.au/__data/assets/pdf_file/0007/848446/Hydrogen-and-Renewable-Energy-Act-Issues-paper.pdf.

[52] "Hydrogen and Renewable Energy Act Explanatory Guide to the Bill" (Government of South Australia, Department of for Energy and Mining, 2023), https://www.energymining.sa.gov.au/__data/assets/pdf_file/0019/905311/Explanatory_Guide_to_the_HRE_Bill.pdf.

[53] "Hydrogen and Renewable Energy Act Issues Paper."

[54] Premier of South Australia, "Landmark Laws to Unlock Hydrogen and Renewable Energy," September 13, 2023, South Australia, https://www.premier.sa.gov.au/media-releases/news-items/landmark-laws-to-unlock-hydrogen-and-renewable-energy.

[55] "South Australia's Hydrogen Opportunity," Department for Industry, Innovation and Science, accessed March 1, 2024, https://industry.sa.gov.au/industrial-transformation/hydrogen-workforce.

Investor response

The activity generated by the Hydrogen Jobs Plan and the Port Bonython Hydrogen Hub has been positive. They have already driven significant investment efforts in the region due to the potential for both renewable energy and green hydrogen offtake agreements, which are needed for proposed GW-scale renewable energy and hydrogen projects to reach financial close.

South Australia's leading position in ramping up to 100% renewable annual contribution for electricity has also attracted interest from international equipment manufacturing companies, specialising in equipment such as transformers[56].

5. Green iron and steel

The prospect of a South Australian transition from traditional coal-based steel-making to low or zero carbon production has been gaining momentum over recent years.

In September 2020, in *South Australia's Climate Change Challenge and Opportunity*, Professor Ross Garnaut wrote, *"In the low carbon world economy, in which hydrogen made from renewable energy reduces ore, the Upper Spencer Gulf can be a globally competitive location for producing iron metal. The unusual confluence of wind, solar and magnetite resources supports low raw material costs. The region has high-quality human skills and capacities, education and training facilities for their expansion, and physical infrastructure for iron and steel"*[57].

The South Australian steel sector is entirely based on the Whyalla steelworks, which was established in 1965 by BHP, and has relied on coking coal ovens and blast furnaces for production. In 2000, BHP spun off its Australian steel-producing assets. Sixteen years later the resulting entity, Onesteel, by then known as Arrium, was placed into voluntary administration[58]. In 2017, British consortium GFG Alliance acquired Arrium.

In 2023, the GFG-owned Liberty Steel Group announced a phase-out of coal-based steel-making, commencing with a $485 million, low carbon electric arc furnace to replace the existing coke ovens and blast furnace at the Whyalla steelworks. State government funding commitment of $50 million of, earmarked prior to the collapse of Arrium to "support co-

[56] Stakeholder interview

[57] Ross Garnaut, "South Australia's Climate Change Challenge and Opportunity," September 2020, https://cdn.environment.sa.gov.au/environment/docs/south-australias-climate-change-challenge-opportunity-rgarnaut-rep.pdf.

[58] "Arrium Limited (ASX: ARI)," accessed February 18, 2024, https://asic.gov.au/about-asic/news-centre/key-matters/arrium-limited-asx-ari/.

investment in capital infrastructure to secure the sustainable future of the Whyalla Steelworks"[59], will be allocated to this investment.

In January 2024, the federal government awarded Liberty $63.2 million towards the purchase and commission of a low carbon electric arc furnace funding via its Powering the Regions Fund[60]. At the same time as the federal government made the Electric Arc Furnace grant announcement, GFG described longer-term plans to establish a 1.8 million tonne per annum direct reduction iron (DRI) plant to process magnetite ore from GFG's nearby mine in the Middleback Ranges, which formed part of the Arrium acquisition.

5.1 South Australia's Green Iron and Steel Strategy

South Australia's Green Iron and Steel Strategy, released in June 2024, outlines the state's vision to become a partner of choice for decarbonised steel-making and to contribute to the global energy transition with its minerals, green iron, and green steel. The strategy brings together workstreams that will:

(1) Enhance South Australia's comparative advantage, for example, by demonstrating the magnitude, quality and development potential of South Australia's iron ore deposits (previously described in the 2017 Magnetite Strategy).
(2) Establish local green steel industry foundations, for example, by supporting, with the federal government, the transformation of the Whyalla Steelworks, commencing with the installation of the EAF described above, and planning for the development of a hydrogen-based Direct Reduction Iron (H2-DRI) plant and supporting value chain. With respect to the H2-DRI, an Expression of Interest seeking partners from businesses to jointly investigate the development of a plant was issued in February 2024.
(3) Identify opportunities to drive additional value for the state, for example, by sharing project benefits with communities, Indigenous Peoples and Native Title groups and introducing green procurement rules.

The potential benefits of the commitment to developing a green iron and steel industry have been demonstrated through a collaborative study by the Port of Rotterdam and Monash University, which shows South Australia's green iron would have a 21% advantage when compared with shipping its raw components to Europe[61].

[59] Government of South Australia Department for Energy and Mining, "Steel Task Force," May 1, 2023, South Australia, https://www.energymining.sa.gov.au/industry/transformational-projects/steel-task-force.

[60] "$200 Million to Help Future-Proof Regional Steel Manufacturing," Ministers for the Department of Industry, Science and Resources, January 31, 2024, https://www.minister.industry.gov.au/ministers/husic/media-releases/200-million-help-future-proof-regional-steel-manufacturing, https://www.minister.industry.gov.au/ministers/husic/media-releases/200-million-help-future-proof-regional-steel-manufacturing.

[61] "South Australia - NW Europe via Rotterdam Supply Chain Case Study."

5.2 Steel Task Force

The South Australian Government had established a Steel Task Force in November 2015, prior to Arrium's collapse, which aimed to secure the future of steel-making in South Australia and prevent Arrium from going into administration[62]. The South Australian Government allocated the Task Force almost $3 million over four years and, in a policy that could be replicated to support green steel production, mandated the use of Australian standard steel in South Australian Government projects[63].

Chaired by South Australian corporate director Bruce Carter, the task force now works closely with GFG Alliance to "create a globally competitive and sustainable industry"[64]. This has included negotiations with both state and Commonwealth governments to secure a commitment from the Commonwealth to fast-track rail upgrades and commit to procurement from GFG, Australia's only rail track manufacturer.

Multiple reported financial restructuring challenges, both within Liberty Steel and the broader GFG Alliance, have raised concerns and speculation regarding the ongoing sustainability of the Whyalla Steelworks. Navigating government decision-making in the context of these commercial sensitivities while maintaining trust and transparency between stakeholders has been a crucial aspect of the task force's role.

Equally, community stakeholders, regional development boards, councils, peak bodies, and mining companies are kept informed and engaged through various platforms such as conferences and consultations[65]. In addition to the informal close working relationships, regular meetings with both the Australian and state government agencies are underscored as crucial elements of the Task Force engagement framework.

Coupled with the dedication of a specialised team, a collaborative and pragmatic approach has enabled swift responses and informed decision-making, ultimately benefiting both the South Australian Government and GFG.

The Strategy & Industry Facilitation team at DEM, responsible for implementing the Green Iron and Steel Strategy, is working closely with the Steel Task Force to ensure the sustainability and long-term prosperity of the state's steel industry.

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[62] Commonwealth of Australia, "Australia's Steel Industry: Forging Ahead," 2017, https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Economics/Futureofsteel45th/Report.

[63] *Ibid*

[64] Department of Energy and Energy & Mining, "Steel Task Force," Text, Energy & Mining, May 1, 2023, South Australia, https://www.energymining.sa.gov.au/industry/transformational-projects/steel-task-force.

[65] Stakeholder interview

6. South Australia's Green Paper on the Energy Transition

In 2023, the South Australian Government commenced an engagement process to develop a "comprehensive energy transition policy for the next three decades"[66].

South Australia's Green Paper on the Energy Transition (Green Paper) includes each of the economic opportunities considered in this case study, along with gas, distributed energy resources and remote area energy supply.

A comprehensive 100-page document, the Green Paper fills both educational and engagement functions, explaining the challenges and opportunities of South Australia's energy and economic transition. It invited stakeholder contributions on a range of issues, including the role and potential of hydrogen, the potential for additional manufacturing and green mining and processing, and health and equity issues.

7. Investment attraction

7.1 Department of State Development, Invest South Australia

As mentioned in Section 1, according to the South Australian Government, the state has attracted over $6 billion investment in large-scale renewable energy and storage projects to date and has around 56 renewable energy proposals worth more than $21 billion in the development pipeline[67] as a result of its investment attraction policies and programs. A further $150 billion potential investment in renewable energy generation and hydrogen electrolyser capacity has been identified[68].

South Australia's Department of State Development (DSD) is charged with building the state's research, innovation and industrial capability, increasing workforce and skills capability and capacity and driving investment and trade to ensure South Australia is well-positioned to capitalise on the state's significant economic opportunities. The Resources, Fuels and Clean Technologies Directorate has a key remit of fostering partnerships globally and nationally to support the ambitious potential growth pathway enabled by low-cost renewable energy.

Invest South Australia (SA), established to fulfil a 2022 Labor Government commitment to provide a dedicated investment attraction capability, is a designated team within DSD. Invest SA's role includes support for building supply chains and industry capabilities by providing tailored project facilitation and case management services. Invest SA is liaising

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[66] Government of South Australia Department for Energy and Mining, "South Australia's Green Paper on the Energy Transition," June 29, 2023, South Australia, https://www.energymining.sa.gov.au/public-consultations/south-australias-green-paper-on-the-energy-transition.

[67] Government of South Australia Department for Energy and Mining, "Leading the Green Economy," March 10, 2023, South Australia, https://www.energymining.sa.gov.au/industry/modern-energy/leading-the-green-economy.

[68] "Invest South Australia, 'Building Global Partnerships in Renewables and Hydrogen Brochure', 2024."

with project proponents to assist with project development by playing a coordinating role across the South Australian Government.

The emergence of supply chain onshoring in international industrial policies and accompanying funding, most notably the *Inflation Reduction Act* in the United States, which includes $520 billion equivalent in funding as well as a package of tax credits and incentives, means that all Australian jurisdictions will struggle to compete for investment solely on the basis of economic incentives. South Australia specifically promotes its unique advantage of being a small government that works collaboratively across agencies to support project proponents.

Other advantages promoted to the investment community include the potential for facilities to be entirely powered by renewable energy and a stable and supportive policy and regulatory environment. Invest SA builds investor confidence by providing support throughout the project development process and showcasing how the government's own investments de-risk subsequent private sector investment[69].

Invest SA's low carbon economy interests include cement, iron and steel, synthetic fuels, renewable energy and hydrogen, with key trading partners including Japan, South Korea and India. In 2023, Invest SA hosted 56 companies on seven trade missions to key markets.

7.2 Austrade

Austrade, an Australian Government initiative, promotes Australia's capabilities to foreign investors, matching investors' needs with opportunities that are in Australia's strategic national interests. Investment attraction includes not only capital, but also technology or the skills or the capability that will add to Australia's economy[70].

Austrade promotes Australia as a whole, working closely with state and territory governments to showcase their unique strengths.

Attracting productive foreign direct investment in green iron and steel is an emerging priority for Austrade's investment attraction activities, which include developing sub-sector strategies and investment value propositions.

8. Other governments

8.1 States and territories

Each State and the Northern Territory has a renewable hydrogen or hydrogen strategy. Queensland is notable for having introduced a far more comprehensive and integrated Queensland Energy and Jobs Plan, which 'sets a path for the transformation of Queensland's electricity system to deliver clean, reliable, and affordable energy[71]. It includes a range of actions to decarbonise the existing system and support the growth of

[69] Stakeholder interview

[70] Stakeholder interview

[71] "Labor's Green Industry Policy Mugged by Reality," Australian Financial Review, November 6, 2023, https://www.afr.com/policy/energy-and-climate/labor-s-green-industry-policy-mugged-by-reality-20231105-p5ehqc.

emerging industries like renewable hydrogen and critical minerals in addition to its *Renewable Hydrogen Action Plan*.

Western Australia, Victoria, Queensland and New South Wales have introduced legislation to regulate the transportation and blending of hydrogen into gas pipelines. The Western Australian Government has made important amendments to its *Land Administration Act 1997* to allow for the introduction of 'diversification leases', which will enable renewable hydrogen development on pastoral lease land.

Queensland's 2024 consultation on regulating the state's hydrogen industry indicates that the outcome will be more akin to South Australia's HRE Act, potentially consolidating existing legislation to modernise and streamline industry development planning and approvals processes across the hydrogen and renewable energy value chain.

Only Western Australia has investigated the development of a green iron and steel sector in a tangible way through the Minerals Research Institute of Western Australia's *Green Steel Value Chain Assessment*, value chain model and a pre-feasibility study for a low emissions iron plant, both of which are modest investments[72].

8.2 Australian Government

While not the focus of this case study, it should be noted that the South Australian outcomes have not occurred entirely in isolation from Australian Government policies. Even during the so-called 'Climate Wars' of 1999 to 2022, an undeniably unambitious period for climate change policy, the Renewable Energy Target played a significant role in underwriting South Australia's renewable energy growth.

The Australian Government has committed to a rapid clean energy transition, setting a target of growing the share of renewable electricity supply nationally to 82% by 2030 and achieving Net Zero emissions by 2050. This sends positive signals to the global clean energy investment community.

The Australian Government has significantly supported the development of a green hydrogen sector, with $2 billion in funding announced in the 2023/24 budget for the Hydrogen Headstart initiative to accelerate development of Australia's hydrogen industry, catalyse clean energy industries and help connect to new global hydrogen supply chains. Other supportive policies include a review of the National Hydrogen Strategy and a Guarantee of Origin scheme[73].

Support for green iron and steel has been strong in a narrative sense and is a strategic priority for the Australian Renewable Energy Agency (ARENA)[74].

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[72] "Green Steel," *Minerals Research Institute of WA* (blog), accessed March 5, 2024, https://www.mriwa.wa.gov.au/minerals-research-advancing-western-australia/focus-areas/green-steel/.

[73] "Hydrogen Industry Update in Australia | Australia | Global Law Firm | Norton Rose Fulbright," accessed March 4, 2024, https://www.nortonrosefulbright.com/en-au/knowledge/publications/413a5b96/hydrogen-industry-update-in-australia.

[74] "Strategic Priorities: Support the Transition to Low Emissions Metals," Australian Renewable Energy Agency, accessed March 5, 2024, https://arena.gov.au/about/strategic-priorities/strategic-priorities-support-the-transition-to-low-emissions-metals/.

Importantly, all of these sectors have been highlighted as integral to the future of Australia's economy. The Federal Treasurer, the Hon Jim Chalmers MP's, keynote address to the Economic and Social Outlook Conference in November 2023 identified four priority areas for a new green energy industry policy:

(1) refining and processing critical minerals,
(2) manufacturing of generation and storage technologies, including batteries,
(3) producing renewable hydrogen and its derivatives, such as ammonia, and
(4) becoming a leading producer of green iron ore, steel and alumina[75].

The 'Future Made in Australia' policy, announced by Australian Prime Minister Anthony Albanese on 11 April 2024, foreshadowed legislation and significant funding to deliver these aspirations[76].

9. Conclusion

South Australia is an Australian leader in enabling green industrial development across industrial renewable energy, renewable hydrogen and green iron and steel. Its ambitious clean energy and export leadership and initiatives have already been successful in attracting significant investment into the state.

From its early recognition of climate change and the economic opportunities presented by renewable energy to the current suite of policy and funding initiatives, the strategic approaches implemented by South Australian governments have been consistent across the technology types and innovation waves over the past two decades: strong narratives embedded in economic policy; timely and ambitious policy, regulation and legislation; de-risking investment through offtake agreements; direct investment and market participation; and industry and community engagement.

South Australia's drive and determination have its genesis partially in the state's historic vulnerability to global market dynamics and lack of significant quantities of export commodities enjoyed by Western Australia (iron ore and LNG) and Queensland (coal and CSG). However, the response to South Australia's unique economic circumstances, both recognising the threat of climate change to the state and identifying the economic potential of the state's world-leading solar and wind resources, was not a foregone conclusion: successive South Australian governments have consistently defined and embedded the low carbon economy narrative in the state's economic direction and ambition.

Effective communication and a strong focus on collaboration, both internal and external to government, have been instrumental in the success of successive policies and programs.

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[75] "Labor's Green Industry Policy Mugged by Reality," Australian Financial Review, November 6, 2023, https://www.afr.com/policy/energy-and-climate/labor-s-green-industry-policy-mugged-by-reality-20231105-p5ehqc.

[76] "A Future Made in Australia | Prime Minister of Australia," April 11, 2024, https://www.pm.gov.au/media/future-made-australia.

Agencies involved in aspects of renewable energy and hydrogen programs, as well as green iron/steel and magnetite mining spanned the Department of Energy and Mines (including the Office of Hydrogen Power SA), Department of State Development, and the Department of Industry, Innovation and Science. In attracting foreign investment to South Australia, Invest SA leverages and promotes the advantages of a small and collaborative government, as well as the government's demonstrated financial commitment and enabling policy environment.

As Australia grapples with the imperative to fast-track its economic transformation, the South Australian approach can provide a template for driving, enabling and de-risking large-scale infrastructure that should be considered by state, territory and federal governments across a range of sectors.

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