Australian National University

Submission: The Role of Western Australia in the Decarbonisation of its Major Trading Partners

ANU Institute for Climate, Energy & Disaster Solutions

This submission is the collated perspective of independent researchers that work at The Australian National University. The views and opinions expressed in this submission reflect those of the authors and contributors.

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10 October 2025

Economics and Industry Standing Committee
Parliament House
4 Harvest Terrace
West Perth WA 6005

Re: Submission Invitation – Inquiry into the role of WA in the decarbonisation of its major trading partners

Dear Mr Rhys Williams,

Please find enclosed a submission by the ANU Institute for Climate, Energy and Disaster Solutions (ICEDS) for the Legislative Assembly of Western Australia inquiry into the role of Western Australia in the decarbonisation of its major trading partners.

Based in the ACT, ICEDS connects industry, governments and communities with climate, energy and disaster-risk research from the Australian National University. Our goal is to advance innovative solutions to address climate change, energy system transitions and disasters. We facilitate integrated research, teaching and policy engagement across disciplines.

The enclosed submission contains contributions from experts in energy transition, renewable fuels, industrial decarbonisation, hydrogen economy, energy economics and policy and energy storage and recovery. The submission is the collated perspective of independent researchers that work at the Australian National University. The views and opinions expressed in this submission reflect those of the authors and contributors.

Our network of ANU researchers will gladly offer further consultation.

Sincerely,

Llewelyn Hughes

Director, Institute for Climate, Energy and Disaster Solutions

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Executive Summary

The Australian National University (ANU) Institute for Climate, Energy and Disaster Solutions (ICEDS) welcomes the opportunity to provide input to the Legislative Assembly of Western Australia's inquiry into the role of Western Australia in the decarbonisation of its major trading partners. Western Australia (WA) has the potential to make significant contributions to its trading partners decarbonisation efforts. It can make its most material contribution by reshaping its export profile from fossil fuels toward renewable-based fuels and value-added green commodities. The co-location of world-class solar and wind resources with major mineral endowments positions WA to lead in green hydrogen production and its derivatives (notably ammonia and sustainable aviation fuels) and in green metals production (especially green iron/steel). Realising this opportunity requires a deliberate shift in policy focus and investment to deliver verifiable emissions reductions for partner economies while sustaining WA's economic prosperity and role as a central supplier to global industry (Burke et al., 2022).

The evidence base presented in this paper, contributed to significantly by ANU academics, indicates that renewable-based green hydrogen is the 'least-regrets' pathway for WA over the 2030–2050 window, outcompeting fossil-based blue hydrogen on both lifecycle emissions and cost trajectories. Off-grid electrolysis powered directly by renewables is projected to undercut on-grid pathways post-2030 and is better placed to satisfy global certification schemes, such as the emerging European Union (EU) certification requirements under RED II regulation (White et al., 2025; Longden et al., 2022). To be accessible to premium markets, WA must align with international certification regimes—particularly the EU—and avoid investments that risk carbon lock-in or stranded assets.

Industry-scale hydrogen supply depends on location-specific combinations of off-grid solar and wind, batteries and hydrogen storage, along with supporting water, port and transmission infrastructure. Government has a catalytic role in streamlining approvals and brokering early international offtakes to overcome first-mover risks (Reedman et al., 2024). A durable transition further depends on targeted workforce expansion and robust First Nations partnerships that deliver direct, real and self-determined benefits to First Nations communities (Burke et al., 2022).

We make the following recommendations:

1. Reorient WA's export strategy towards renewable-based and value-added low-carbon commodities.
2. Align information systems, such as certification systems, to expand WA's green export market to key trading markets.
3. Align state investments with Commonwealth priorities to leverage programs under the National Hydrogen Strategy 2024 and the Future Made in Australia plan.
4. Ensure government and industry engage in fair and just benefit-sharing models and free, prior and informed consent processes with First Nations people and native title holders. The transition to renewables-based export markets in WA presents a significant opportunity for First Nations people.
5. Address workforce gaps in renewable generation and green export industries with proactive, targeted upskilling.

6. Utilise research assessing investment requirements to achieve net zero, such as HILT CRC project RP3.007, to inform industrial decarbonisation investment decisions – ensuring that locations for renewables and green metals projects are located strategically.

The Role of WA in the Decarbonisation of Major Trading Partners

WA's most significant opportunity to support regional decarbonisation lies in replacing fossil fuel exports with zero-carbon electricity and fuels, and with value-added green commodities. The consequential, downstream emissions associated with Australia's export basket are large, particularly in the Asia-Pacific context; shifting to zero-carbon exports allows WA to deliver emissions reductions abroad that materially exceed its domestic footprint while maintaining its role as a supplier of materials to global industry (Burke et al., 2022).

Shifting Western Australia's Global Footprint

Recommendation 1: Reorient WA's export strategy towards renewable-based and value-added low-carbon commodities.

The Asia-Pacific has had exceptional growth in energy use and is the world's largest greenhouse-gas emitting region. Australia's contribution has been essential to meeting the region's energy and resource needs, becoming one of the world's largest exporters of coal, liquefied natural gas, iron ore, and alumina (Burke *et al*., 2022; White et al, 2023). Analysis however has linked these exports to significant emissions at the point of use or processing, accounting for about 8.6% of the total greenhouse gas emissions of the Asia-Pacific (Burke et al, 2022). A key point is that (as shown in appendix 1 from Burke *et al. (2022)*), Australia's domestic carbon footprint is dwarfed by its current commodity export carbon footprint from end-use in other countries. If WA is looking to contribute to global decarbonisation, then its biggest opportunity is through decarbonising its export profile.

Three pathways by which Australia could instead export zero-carbon energy and products include direct exports of renewable electricity via sub-sea cables, exports of zero-carbon fuels such as green hydrogen, and the export of green metals and refined ores processed from Australian ores using renewable energy. There is a significant opportunity in not only replacing WA's fossil fuel exports with exports based on renewable energy such as green hydrogen, ammonia and sustainable aviation fuels (SAFs), but also in value-adding to mineral exports, particularly direct reduction iron or DRI, using renewables and hydrogen as an input into global green steel production.

Burke *et al (2022)* calculate that Australia has the land and renewable energy resources to become a key exporter of these commodities. Realisation of this potential relies on ongoing cost reductions, growing demand-side interest linked to meeting ambitious emission reduction targets in the region, and the development of cross-border frameworks for clean energy trade. If it were to achieve this goal, Australia could make a sizeable contribution to regional decarbonization via renewable energy-based exports. Though there is clearly significantly potential for decarbonisation of Australia's export profile, it also must be noted than in relation to many of the green metals and refined ores mentioned above that currently technologies exist but must be proven and applied in the WA context. A step in which the WA government can take on a catalytic role.

Aside from the potential for decarbonisation of WA's export profile, which is substantial, Western Australia also has significant potential to reduce domestic emissions from production processes for green metals, such as alumina. Though the emissions profile for alumina is small compared to iron and steel in the global picture, it contributes significantly to Australia's domestic emissions and provides opportunity for Western Australia to contribute to decarbonising the alumina production process. This is also the topic of a large project in the HILT CRC, AlumiNEXT, in which ANU academics play a small role.

WA's Potential to Supply Zero-Carbon Commodities

Thanks to its high-quality solar and wind resources, WA is well placed to develop new energy-intensive export industries built around value-added commodities. Priority opportunities include onshore processing of metal ores, the production of zero-carbon chemicals, and the provision of synthetic aviation and bunkering fuels—applications that align with the emerging global consensus on where hydrogen will be most valuable (White et al., 2023; Ueckerdt et al., 2021). WA also has potential to supply minerals that are critical to the energy transition, which in turn can drive demand for hydrogen across the mining sector (Salmon and Bañares-Alcántara, 2021). Recognising these opportunities will shape the type and siting of hydrogen infrastructure, which may not always coincide with existing commodity export terminals.

Zero-carbon export growth will occur in a competitive global environment. Other regions possess substantial clean-energy potential, and natural gas has historically become more affordable due to expanding supply and lower transport costs. However, gas's emissions profile places it at a long-run disadvantage to zero-carbon energy, and recent volatility linked to global conflicts has underscored price risk. By contrast, Australia—particularly WA—combines proximity to key Asia-Pacific economies with sizeable, co-located renewable and mineral endowments, providing a strong platform to supply verified low-emission products (Burke et al., 2022).

Hydrogen

Across the 2030–2050 period, renewable (green) hydrogen is expected to outcompete blue hydrogen while delivering superior emissions reductions locally and globally. CSIRO's modelling for Australia's National Hydrogen Strategy 2024 finds that, in all scenarios, blue hydrogen represents only a minor share of total national production (Reedman et al., 2024). The WA Government's focus on renewable hydrogen in its 2023 strategy refresh is therefore well-targeted.

There are clear reasons to prioritise green over blue hydrogen. Emissions intensities differ markedly across production methods; choices made for large-scale deployment will strongly influence greenhouse gas outcomes over the next three decades (Longden et al., 2022; Stocks et al, 2022). While there may be a narrow, time-bound window in which blue hydrogen is cost-competitive, analyses indicate that blue assets built over the next three decades risk significant under-utilisation and potential stranding (George et al., 2022; White et al., 2023). A therefore 'least-regrets' pathway is to accelerate cost reductions in green hydrogen while building manufacturing capability and supply chains both domestically and abroad. Though prioritising green hydrogen production puts focus on decreasing Australia's domestic emissions, it also allows for significant decarbonisation of our major trading partners through exporting liquid hydrogen fuel or commodities with embedded hydrogen, such as e-SAF, e-methanol or ammonia, to replace fossil-fuel based alternatives.

Research from the HILT CRC demonstrates that reliable, continuous hydrogen supply for industry can be achieved most cost-effectively through tailored combinations of off-grid solar, wind, batteries, and hydrogen storage. Accounting for geographic, land, and construction cost factors, these studies found transported hydrogen is cheaper than transporting electricity and that levelised costs vary by hub depending on renewable quality and geological storage options. Using GenCost projections, work in the Pilbara, Port Hedland, and Kwinana highlights how future build timing could shape system costs and guide the sequencing of hub development (see appendix 2).

Green Steel / Iron

WA is also well placed to support Australian hydrogen-based iron/steelmaking. The state hosts some of the world's largest economically demonstrated iron-ore reserves (Yelishetty et al, 2012) and supplies ~38% of global iron-ore production (Government of Western Australia, 2024). In the Pilbara, high-quality renewable resources sit close to those deposits, creating favourable conditions for low-cost renewable hydrogen (Wang et al., 2023; World Bank Group, 2024) — one of the largest cost components in hydrogen-based ironmaking (Van Vuuren et al., 2022).

Recent analysis indicates that the assumption that only high-grade ores suit green steel is too narrow (Rahbari et al, 2025). Alternative production processes examined by ANU academics, such as the two-stage smelter-BOF route, demonstrates that green steel can be produced from low-grade ores and can be highly competitive in cost. Although the cheapest green-steel pathway is still roughly ~50% more expensive than conventional BF–BOF at a hydrogen price of about USD 3.5/kg, this cost disparity will only improve in the favour of green steel as renewables-based hydrogen becomes cheaper and demand for low-carbon steel increases (Rahbari et al, 2025).

Hydrogen's role in green steel / iron making therefore presents a strategic opportunity for WA in both domestic production and export (Venkataraman, 2022). We recommend continuing technical and feasibility analyses to optimise plant design, siting and supply chains so WA can translate its ore endowment and renewable advantage into competitive, low-emissions iron and steel (White et al, 2023).

Green Product Certification

Recommendation 2: Alignment of information systems, such as certification systems, will be crucial for expanding WA's green export market to key trading markets.

Though there is significant opportunity for WA to capitalise on the production of green commodities and value-added materials, alignment of information and certification systems will be pivotal for export success (White et al, 2025). Certification schemes are emerging globally to establish emissions credentials for hydrogen, and in 2023 the European Union (EU) adopted regulations under the Renewable Energy Directive II (RED II) that codify when renewable electricity used in electrolysis can be categorised as renewables based (White et al, 2023). This determines which hydrogen counts toward EU climate targets and, given the EU's expected import demand, has direct implications for international exporters.

Work done by an ANU research team (see appendix 3) indicate that off-grid renewable hydrogen in WA is likely to be cheaper than on-grid electrolysis and, critically, more likely to comply with EU carbon certification requirements (White et al, 2025). More broadly, robust certification systems are essential to efficient international trade, emissions transparency, and competitive markets. Incompatibilities between exporting and importing regimes risk becoming technical barriers that undermine market efficiency and interoperability (White et al, 2025).

We recommend then ensuring WA exports align with international green product certification schemes and for the WA Government to aid in brokering initial offtake agreements to de-risk first-mover projects, following models such as the Australia–Germany H2Global joint tender.

Barriers and Opportunities to Industrial Decarbonisation in Western Australia

Recommendation 3: Align state investments with Commonwealth priorities to leverage programs under the National Hydrogen Strategy 2024 and the Future Made in Australia plan.

Aligning Government Support and Investment

Australia's first National Hydrogen Strategy (COAG, 2019) highlighted a broad range of range of both export- and domestic-focused opportunities for hydrogen technology deployment in Australia. Since the release of this strategy in 2019, both the WA government and the private sector have made significant investments in a broad range of hydrogen applications (HyResource, 2024). However, the Australian Government is now increasingly focussing its investment in areas where both hydrogen technologies and Australia are considered to have greatest comparative advantage. This is reflected in the updated National Hydrogen Strategy released in 2024 (DCCEEW, 2024). The revised strategy identifies several priority end-use areas for Australia's hydrogen industry (ammonia, green minerals/metals, heavy mobility, and the power sector). The updated strategy provides the latest vision for Australia's hydrogen industry and a framework to guide Federal government investments such as the Future Made in Australia Plan.

The WA Government can increase the return on its hydrogen industry investments by aligning its investments with the priorities of the Australian Federal Government. This will enable WA to leverage funding from major national initiatives such as the Hydrogen HeadStart Program, the Hydrogen Production Tax Incentive, and other Future Made in Australia initiatives. Investments in non-priority areas, e.g. addition of hydrogen to natural gas distribution networks, are unlikely to leverage significant levels of Federal Government support.

Social and Cultural Sustainability of WA Green Industry

Recommendation 4: Ensure government and industry engage in fair and just benefit-sharing models and free, prior and informed consent processes with First Nations people and native title holders. The transition to renewables-based export markets in WA presents a significant opportunity for First Nations people.

Export markets present a significant opportunity for First Nations to leverage land and infrastructure assets within a new, low-emissions export model. First Nations people hold native title rights over much of northwest Australia, creating a clear impetus for the renewable energy industry to negotiate access and structure agreements that deliver enduring benefits to Aboriginal landholders (White et al, 2023). To date, many Indigenous communities have not received substantial benefits from Australia's mining boom and genuine processes of free, prior and informed consent have been lacking (Burke et al, 2022). The emergence of utility-scale renewables and green export industries in Northern Australia offer the chance to adopt a more just and inclusive model of benefit sharing; one that allows First Nations people, whose land these developments take place on, to self-determine their benefits and futures alongside energy companies. Creating genuine opportunities for Indigenous people is not only central to sustainable development but also foundational to the social licence required for WA's export-oriented decarbonisation and Australia's ongoing reconciliation efforts.

Workforce Gaps in Green Exports

Recommendation 5: Proactively address workforce gaps in renewable generation and green export industries with targeted upskilling.

We anticipate material workforce gaps across renewable energy generation and enabling infrastructure—utility-scale solar and wind, transmission build-out, and storage—required to support green export production. These gaps will span development, construction, and operations, and are likely to be amplified by the regional location of prospective hubs.

Green ammonia production, however, draws on processes with transferable skills from existing fossil-fuel based ammonia production. As well as this, green direct reduction iron, though a markedly different process, will have transferable skills from blast furnace fossil fuel iron production. This provides a practical pathway for timely workforce transition, with targeted upskilling focused on applying existing competencies to ammonia and iron production that use renewable inputs.

Aligning Research with Investment

Recommendation 6: Utilise research assessing investment requirements to achieve net zero, such as HILT CRC project PR3.007, to inform industrial decarbonisation investment decisions – ensuring that locations for renewables and green metals projects are located strategically.

HILT CRC has undertaken location-specific analysis of energy demand and enabling infrastructure—covering electricity, heat and hydrogen—to determine the level of public investment required for heavy industry to reach net zero by 2050 under a set of plausible, industry-informed scenarios. The flagship project, RP3.007, *Unlocking Investment in Energy Infrastructure for Net Zero Industrial Hubs* (launched August 2024) extends this work to quantify capacity needs and infrastructure sequencing to support the transition.

Early findings show that the transmission network zones identified in the SWIS region (Southwest Interconnected System - Perth, from Albany (south) to Kalgoorlie (east) up to Kalbarri (north)) scored well when assessed for renewable energy development potential. The resulting maps show strong alignment between high-scoring areas and the eleven transmission network zones in the SWIS Whole of System Plan (Government of Western Australia, 2025), providing an evidence base for prioritising investment and staging industrial hub development (see appendix 4).

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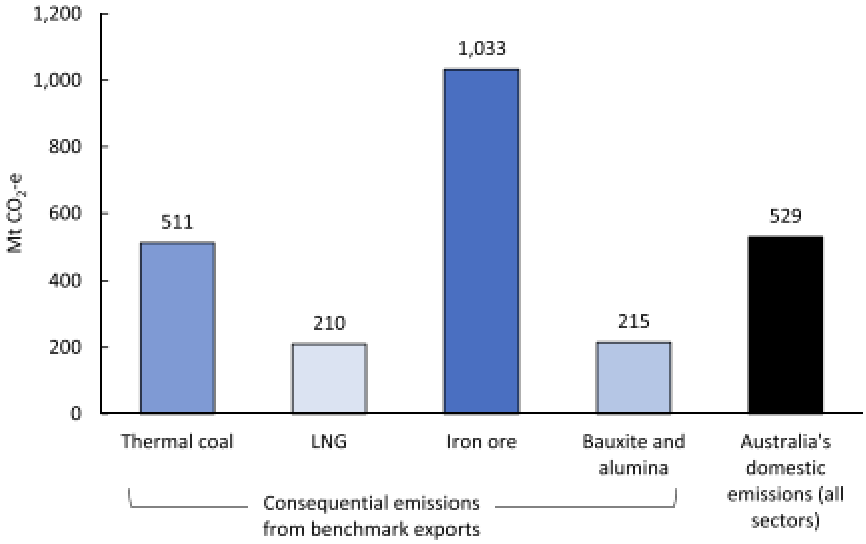
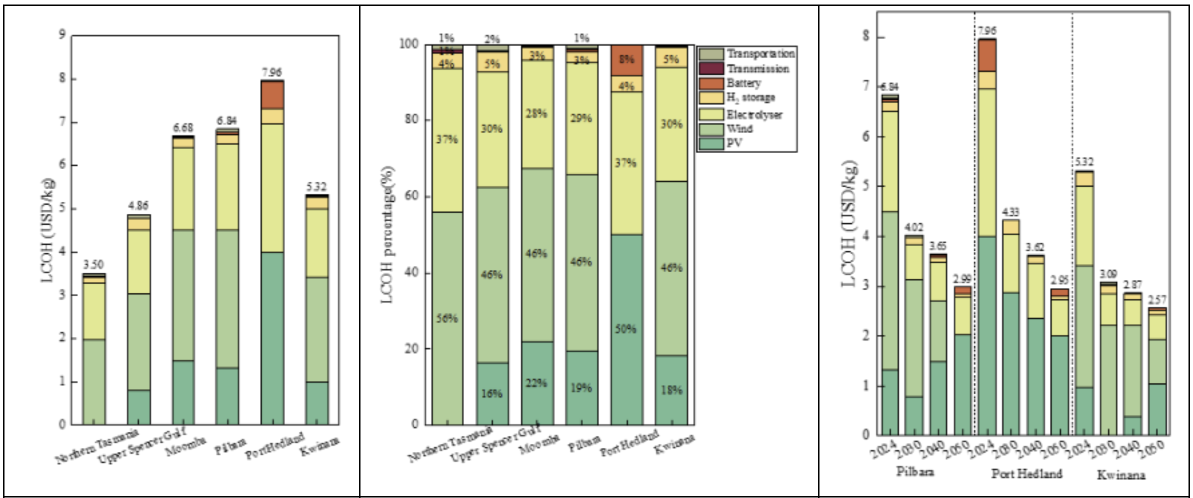
Appendices

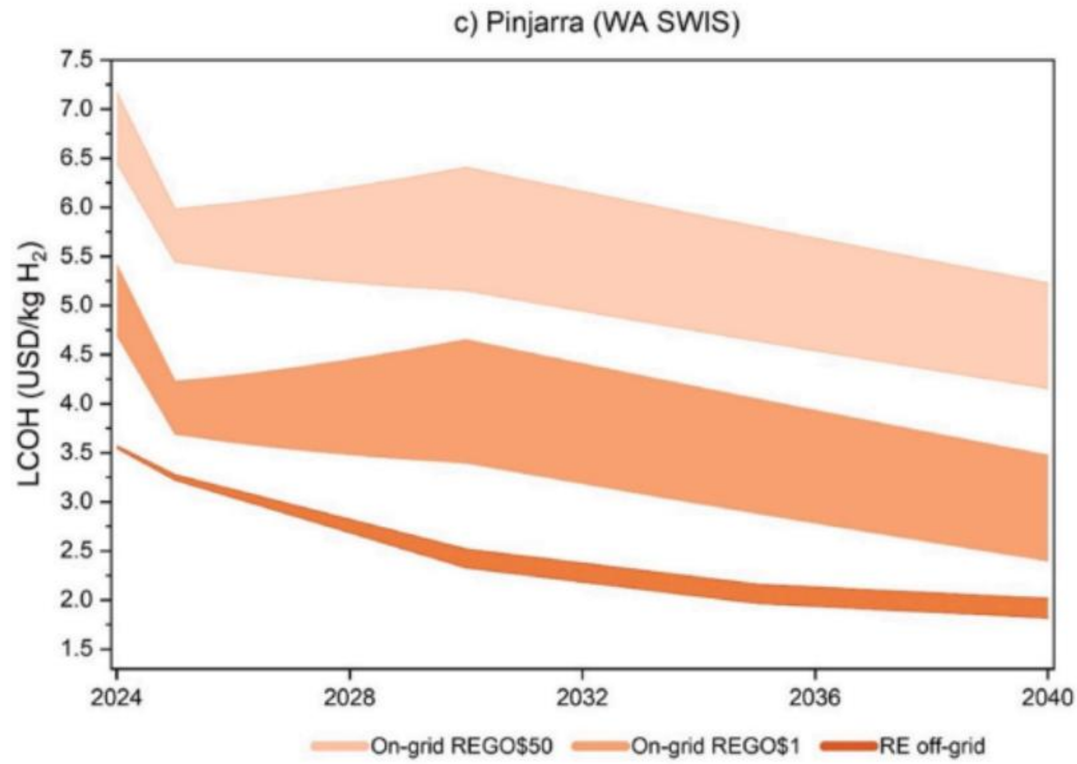


Appendix 1: Figure from Burke et al. (2022) showing 2018-2019 emissions from Australian key resource exports.

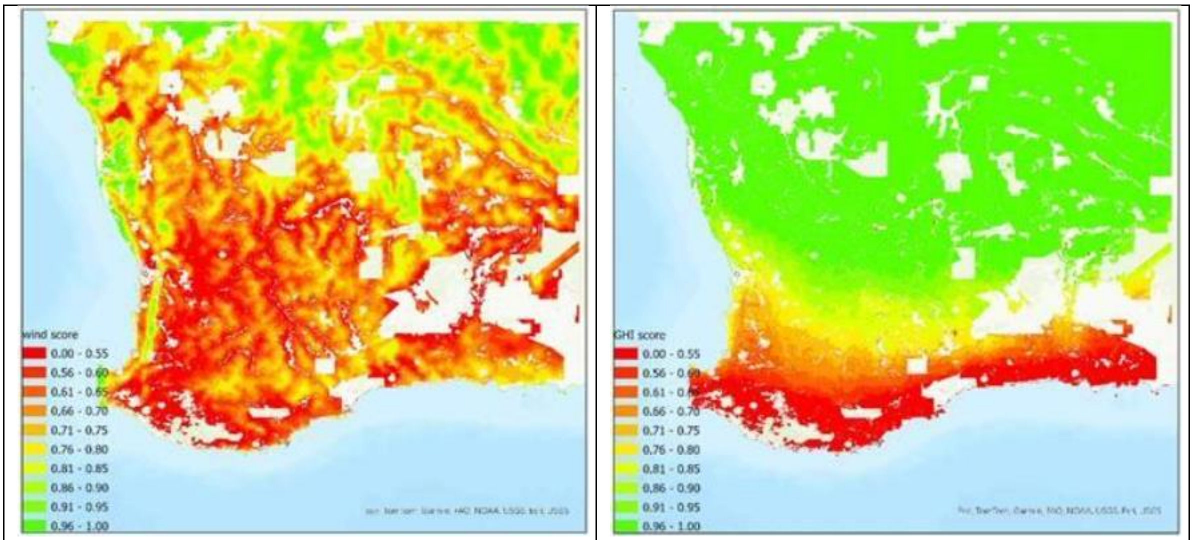


(a) (b) (c)

Appendix 2: Levelised cost of hydrogen (LCOH) estimates for all locations, showing contributions from different system components as (a) total costs, and (b) percentage breakdown. (c) Estimates for hydrogen systems built in future years in the three WA hubs (Pilbara, Port Hedland and Kwinana), showing contributions from different system components.



Appendix 3: From White et al (2025). Shows cost envelopes for off-grid versus on-grid hydrogen in WA, showing variation over time in projected production costs under each scenario. There is much more uncertainty in on-grid scenarios due to uncertainty around wholesale electricity prices.



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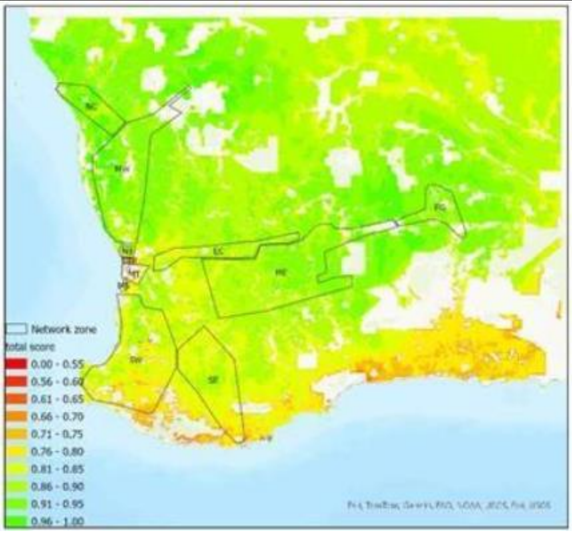

(c)

Appendix 4: Scoring maps for the SWIS region: (a) wind resource scoring based on annual wind speed from BARRA2 (Su et al, n.d.); (b) solar resource scoring based on annual GHI from Himawari (Australian Government, 2024); (c) combined scoring map with overlay of the eleven transmission network zones from the SWIS Whole of System Plan. The approach follows AEMO's methodology for defining REZ boundaries (Australian Energy Market Operator, 2018).

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