ZERO CARBON HYDROGEN AUSTRALIA
A DIVISION OF SMART ENERGY COUNCIL

Strategic Hydrogen

Aligning Australia–India Energy and Industrial Decarbonisation Goals

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Prepared by
Smart Energy Council (Australia)

SMART ENERGY COUNCIL

ON BEHALF OF

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

HIGH COMMISSION OF INDIA, CANBERRA
सत्यमेव जयते

About

The independent body for the Australian smart energy Industry. We actively connect the smart energy industry across Australia, building momentum and unlocking barriers to a future built on renewables. Driven by our members from across the smart energy industry, we provide tailored solutions and practical help to meet their individual needs. We believe the world is changed by those who show up. We are a not-for-profit organisation, driven by our 1000+ members from across the smart energy industry. Our members include Australian and international businesses of all sizes. <<smartenergy.org.au>>

Zero Carbon Hydrogen Australia is an initiative, operating under the Smart Energy Council, advocating for the development of a zero-carbon hydrogen industry in Australia. It focuses on promoting renewable hydrogen production and its derivatives, including green ammonia and green metals, for both domestic and export markets. The initiative is closely linked to Australia's National Hydrogen Strategy, which aims to position Australia as a global leader in green hydrogen production and export.

Team

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John Grimes

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Will Carr

FOREWORD

From
John Grimes,
Chief Executive Officer,
Smart Energy Council

To
His Excellency, Mr Gopal Baglay,
High Commissioner of India to Australia

Your Excellency,

It is with great respect and a deep sense of shared purpose that I present to you, and through you to the High Commission of India and the Ministry of New and Renewable Energy, this report: *Strategic Hydrogen – Aligning Australia–India Energy and Industrial Decarbonisation Goals.*

This work is the culmination of close and constructive collaboration between the High Commission of India in Australia and the Smart Energy Council, undertaken through our specialist division, Zero Carbon Hydrogen Australia. It has been guided by the spirit and objectives of the New India–Australia Renewable Energy Partnership, launched by Prime Minister Anthony Albanese and Prime Minister Narendra Modi in November 2024, and is intended to complement the important work of the India–Australia Green Hydrogen Taskforce.

Our two nations stand at a pivotal juncture in the global energy transition. The task before us is not only to advance our domestic renewable energy ambitions, but to design and deliver an integrated green hydrogen economy that will accelerate industrial decarbonisation across the entire Asia-Pacific region. This report provides an evidence-based framework for achieving that goal, identifying targeted opportunities where India's manufacturing scale, industrial demand, and rapid deployment capability can be paired with Australia's world-class renewable energy resources, critical minerals, and trusted export standards.

The analysis underscores a simple truth: our shared success will come not from building a "hydrogen industry" in isolation, but from deploying green hydrogen precisely where it is most effective — displacing fossil fuels in hard-to-abate sectors such as steel, ammonia, maritime transport, and industrial heat. By aligning policy frameworks, mobilising catalytic finance, building a shared workforce, and harmonising certification systems, India and Australia can create a model of bilateral cooperation that delivers tangible climate, trade, and economic outcomes.

On behalf of the Council and our members, I commend this report to you and to our partners in the Government of India.

Yours sincerely,

John Grimes
Chief Executive Officer
Smart Energy Council

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EXECUTIVE SUMMARY

The collaboration between India and Australia in green hydrogen manufacturing and deployment marks a pivotal opportunity—not to build a singular hydrogen industry, but to enable deep decarbonisation across strategic sectors. Rather than framing green hydrogen as a market in itself, this report repositions it as a mechanism for displacing fossil fuel use in targeted applications such as steel, ammonia, heavy transport, and industrial thermal loads.

Australia and India bring complementary strengths to this challenge. Australia possesses world-leading renewable energy resources, technological expertise in hydrogen production, and potential export capacity. India, meanwhile, offers a growing industrial base, strong domestic demand for hydrogen derivatives, and a policy environment that favours rapid deployment via simplified production tax credits and national mission funding.

>80%

Share of Australia's hydrogen exports expected to go to Indo-Pacific markets [1]

>90%

Australia's cost reduction target for renewable hydrogen by 2035 [2]

>$80 B

Potential market value of India–Australia green hydrogen trade by 2050 [3]

This report explores how bilateral efforts—anchored in agreements such as the Australia–India Economic Cooperation and Trade Agreement (ECTA), the Critical Minerals Investment Partnership, and the India–Australia Renewable Energy Partnership—can unlock value across four focus areas:

- **Targeted Green Hydrogen Manufacturing:** Establishing a cost-competitive hydrogen supply chain for sector-specific uses, especially green ammonia and green steel, while avoiding false equivalence between vastly different value chains.
- **Technology and Innovation:** Advancing joint R&D in electrolysis efficiency, transport, storage, and embedded applications of green hydrogen in industrial systems.
- **Investment and Trade Mechanisms:** Mapping viable pathways for concessional finance, sovereign guarantees, and long-term offtake contracts, with emphasis on tradeable clean commodities and bilateral risk de-risking structures.
- **Regulatory and Policy Coordination:** Promoting interoperable standards, certification systems, and trade architecture (such as the Clean Commodity Trading Initiative), while recognising that India's centralised policy execution differs sharply from Australia's federated and politically fragmented model.

By reframing green hydrogen as a decarbonisation enabler rather than a commercial end-state, this report provides actionable insights for policymakers, industry leaders, and investors. The goal is not to build a hydrogen economy for its own sake—but to strategically deploy hydrogen where it works, in service of emissions reductions, energy security, and bilateral prosperity.

Introduction: Reframing Green Hydrogen

The purpose of this research is to identify high-impact, sector-specific pathways to deepen India–Australia collaboration on the deployment, manufacturing, and trade of green hydrogen and its derivatives. However, rather than treating green hydrogen as a standalone industry, this report reframes it as a targeted decarbonisation tool—best applied where electrification is unviable, and where hydrogen can displace fossil fuels in high-temperature, high-emission industrial processes.

By examining bilateral policy frameworks, concessional investment tools, and regional trade instruments, including the **Australia–India Economic Cooperation and Trade Agreement (AI-ECTA)** [5], the **Comprehensive Economic Cooperation Agreement (CECA)** [6], and the **Critical Minerals Investment Partnership**—this report maps strategic opportunities for joint value creation across priority use-cases. The findings are intended to support industry, government, and investors in aligning their capabilities, de-risking capital flows, and accelerating deployment across supply chains critical to both nations' clean energy ambitions.

The India–Australia green hydrogen collaboration is shaped by a dynamic ecosystem of actors spanning national governments, industrial consortia, and multilateral frameworks.

India's National Green Hydrogen Mission [7] and Australia's Hydrogen Headstart program [8] are anchoring policy intent; institutions like the Clean Energy Finance Corporation (CEFC) and Australian Renewable Energy Agency (ARENA) are directing early-stage funding; while industry is forming cross-border joint ventures in electrolysers, critical minerals, ammonia production, and renewable project development [9].

Frameworks such as AI-ECTA and CECA provide legal scaffolding for trade and investment, while partnerships through the QUAD and Indo-Pacific Economic Framework (IPEF) support regional integration [10]. Together, these mechanisms form the basis of a bilateral clean energy corridor—stretching from Australian resource extraction and renewable power generation to Indian value-added production and regional export.

This collaboration is not merely beneficial; it is strategically necessary. Coordinated Australia–India action is essential for building secure, low-emissions industrial supply chains in the Indo-Pacific. In sectors where green hydrogen is the most viable decarbonisation vector, both nations can jointly pioneer scalable pathways that support domestic emissions targets and catalyse a new class of tradeable clean commodities.

Importantly, the report also recognises that some hydrogen applications—especially those reliant on distributed energy or operating below grid parity—may require public infrastructure investment to be commercially viable. These interventions must be considered in context, especially when existing fossil fuel subsidies distort market comparisons [11]. By mobilising capital, aligning policy, and deploying infrastructure in the right sectors, Australia and India can lead the global transition not by building a "hydrogen industry," but by deploying hydrogen where it works—efficiently, equitably, and at scale.

Organisations such as the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) are playing a vital role in fostering alignment on international standards, safety protocols, and technology benchmarks [12]. These multilateral efforts support the emergence of an integrated, rules-based green hydrogen market across the Indo-Pacific—grounded in transparency, interoperability, and regional security.

While green hydrogen is often presented as a single global market, its true momentum stems from its value as a targeted decarbonisation vector. Countries are increasingly recognising hydrogen's potential not as a catch-all solution, but as a flexible input to reduce emissions in hard-to-abate sectors [13]. This nuance is critical: **successful deployment depends not just on ambition, but on precisely where and how hydrogen is used.**

To date, 53 countries have adopted national hydrogen strategies, with another 30 actively developing roadmaps [14]. But these strategies differ widely in their policy design, delivery mechanisms, and industrial focus. Without greater clarity on use-case segmentation, many risk over-generalising hydrogen's role—resulting in misaligned incentives, stranded infrastructure, and fragmented markets.

The global market for green hydrogen is expected reach $38.1 billion by the end of 2029, at a compound annual growth rate (CAGR) of 48.7% during the forecast period of 2024 to 2029 [15]

For Australia and India, the opportunity lies not in chasing a monolithic "hydrogen economy," but in co-developing targeted, interoperable frameworks that reflect their respective comparative advantages. These include Australia's upstream renewable and mineral resources and India's downstream manufacturing scale and demand-side pull—supported by bilateral platforms and regional trade instruments [16].

This report positions the India–Australia partnership as a model for pragmatic collaboration: where policy, capital, and technology are steered not toward hydrogen for its own sake, but toward measurable decarbonisation outcomes, export viability, and regional stability. Building on this foundation, the report identifies the emerging groundwork for tangible, industry-led projects between Australia and India, particularly in areas where coordinated policy, catalytic capital, and early commercial signals can de-risk investment and accelerate scalable deployment.

See APPENDIX A: KEY BUSSINESSES & PROJECTS

METHODOLOGY

This report adopts a pragmatic, developer-informed approach grounded in the lived experience of project proponents, technology providers, and system architects operating across both Australia and India. Rather than relying on abstract modelling or national-level averages, our methodology centres on firsthand insights gathered through semi-structured interviews, roundtables, and confidential consultations with stakeholders actively shaping green hydrogen supply chains.

Developer-Informed Supply Chain Scorecard

At the heart of our analysis is a Supply Chain Scorecard, developed to assess the real-world viability and accessibility of critical infrastructure and policy enablers—including:

- Access to renewable electricity (solar, wind, hydro)
- Electrolyser availability and local manufacturing
- Water and land security
- Transmission capacity and port access
- Offtake markets and financing mechanisms

Rather than defaulting to national statistics (e.g. total GW of renewables or theoretical production targets), the Scorecard reflects project-level realities. Developers were invited to rate—from 1 to 5—the adequacy of cost-effective access to each enabler based on their actual project context. These locationally sensitive inputs capture the infrastructure bottlenecks, regulatory mismatches, and resource constraints that national averages often obscure—especially in remote, off-grid, or export-oriented regions.

Each score represents a composite view across four dimensions:

- Infrastructure presence and quality
- Policy support and regulatory maturity
- Cost, availability, and lead time
- Feasibility of interconnection or integration

While this report includes input from Australian developers, equivalent perspectives from Indian developers—particularly those engaged during the roundtable—are still being consolidated. A more detailed analysis of Indian market insights will be included in a forthcoming iteration of this research. A follow-up report is recommended to provide balanced developer insights from both countries, including market sentiment on financing, certification, and policy gaps.

Policy Mechanism Evaluation

To complement the supply chain lens, we conducted qualitative assessments of policy interventions known to catalyse low-carbon infrastructure. Drawing from international case studies and participant feedback, we evaluated the potential impact of “gold standard” mechanisms such as:

- Contracts-for-Difference (CfD) [17]
- Concessional or blended finance
- Tradeable certification schemes (e.g. Guarantee of Origin)
- Sovereign offtake guarantees and public procurement mandates

Rather than scoring these interventions via formal survey instruments, participants discussed and prioritised them in structured dialogues—offering commentary on where bilateral coordination could strengthen policy delivery, improve investor confidence, and avoid duplication.

Baseline Assessment: Ambitions & Status

Australia and India are positioning themselves as strategic partners in the global shift to clean industrial energy—not by building a generic hydrogen industry, but by focusing on green hydrogen as a targeted decarbonisation mechanism. Both nations are developing integrated supply chains underpinned by national strategies that prioritise production, trade, and hard-to-abate sector transformation.

Australia is leveraging its world-class renewable and critical mineral resources to enable upstream hydrogen production and green commodity exports. India, by contrast, is scaling its manufacturing base—particularly in electrolysers and derivatives like green ammonia—while cultivating a strong domestic demand base driven by policy ambition and industrial need. Unlike many Asia-Pacific economies that remain hydrogen importers, Australia and India are co-developing an interoperable, standards-based ecosystem that presents a democratic, rules-aligned alternative to China's vertically integrated dominance.

Challenges and Barriers to Market Expansion

- **Limited long-term demand signals** (offtake agreements, especially government-backed, remain scarce) [18]
- **Infrastructure fragmentation** across storage, ports, workforce, and transmission in priority regions [19]
- **High green hydrogen costs** remain a key barrier, especially against cheaper fossil-based alternatives [20]
- **Lack of harmonised certification standards** for hydrogen and derivative trade across jurisdictions [21]
- **Land and water constraints** in arid or environmentally sensitive regions risk bottlenecks to scale [22]

Despite strong policy ambition and projections of significant market growth, the green hydrogen sector in both Australia and India remains in its formative phase. Industry actors consulted for this report highlighted barriers such as offtake uncertainty, weak infrastructure alignment, limited domestic demand certainty, and a fragile global investment climate. Many companies are currently prioritising project survival over expansion, particularly in the face of rising capital costs and shifting global incentives. This reality tempers near-term business to business engagement potential but reinforces the need for policy coordination and joint government action.

FUTURE OUTLOOK & OPPORTUNITIES

- **Rapid declines in electrolyser costs,** unlocking more commercially viable production models [23]
- **Bilateral and multilateral trade agreements** will accelerate trusted clean hydrogen flows [24]
- **Steady demand growth in hard-to-abate sectors,** such as steel, fertilisers, and maritime transport [25]
- **Green derivatives—like ammonia and methanol—positioned as early-stage export champions** [26]

From Potential to Profit: Navigating Green Hydrogen Market Dynamics

Key Insight: Renewables Shift the Cost Curve

Unlike fossil fuels, renewable-powered hydrogen projects incur front-loaded capital expenditure but enjoy zero marginal fuel costs post-commissioning. This shift means:

- Once assets are amortised, operational expenditure (OPEX) drops significantly.
- Long-term hydrogen pricing becomes more predictable and inflation-insulated.
- Green hydrogen becomes increasingly cost-competitive—especially where capital costs are lowered through concessional finance or government guarantees.

Comparative Table: Australia vs India Green Hydrogen Economics

Metric	Australia	India
LCOH (2024 est.)	$3.50–$5.00/kg H_2 [27]	$2.80–$4.20/kg H_2 [28]
Sovereign risk rating	AAA (low risk, lower cost of capital) [29]	BBB– (higher risk premium, costlier debt) [29]
Financing environment	Strong institutional investment appetite; CEFC, ARENA, blended finance tools [30]	Reliant on government tenders, viability gap funding, and multilateral finance [31]
Domestic market size	Small, export-led demand (limited domestic offtake) [32]	Large, growing domestic demand for green steel, ammonia, transport [33]
Land & water access	Land abundant but constrained in Pilbara; water access expensive in arid zones [34]	Land tighter, but major coastal hubs (e.g., Gujarat) offer strategic siting [35]
Electrolyser manufacturing	Limited local capability; reliant on imports [36]	Strong manufacturing pipeline under National Hydrogen Mission [37]
Transmission & port readiness	World-class ports; grid bottlenecks in regional zones [38]	Rapid grid buildout, targeted hydrogen corridors, key coastal hubs [39]
Export competitiveness	High-purity hydrogen derivatives (e.g., green ammonia for Japan, Korea) [40]	Cost-competitive green ammonia & urea for Global South and domestic use [41]

STRATEGIC SUMMARY

- Australia's strengths lie in geopolitical stability, renewable and mineral resources, and trusted export standards. It can attract low-cost capital and premium export markets but must solve for domestic offtake, scale, and infrastructure.
- India's strengths lie in scale, speed, and manufacturing cost advantage. It can drive rapid adoption domestically and regionally but must address capital constraints and certification trust in export markets.

Together, a joint value chain model—where Australia supplies low-risk green molecules and India drives cost-effective conversion and deployment—creates a win-win pathway to accelerate decarbonisation across the Indo-Pacific.

Policy Levers and Industry Support: Australia-India Landscape

The following tables provide a comparative snapshot of the core policy mechanisms and industry support structures shaping green hydrogen development in Australia and India. These include national and subnational initiatives spanning concessional finance, infrastructure co-investment, R&D programs, and flagship market accelerators—such as Australia's Hydrogen Headstart and India's National Green Hydrogen Mission.

This baseline mapping serves three strategic purposes:

- Clarifying the policy mix each nation is using to address cost, risk, and scale barriers in the hydrogen value chain;
- Highlighting areas of complementarity where bilateral alignment, joint ventures, or harmonised certification could accelerate progress; and
- Identifying replicable interventions that enable technology deployment, domestic manufacturing, and export competitiveness.

By comparing the policy ecosystems side-by-side, we reveal opportunities for structured collaboration—through knowledge transfer, aligned standards, and shared infrastructure strategies—that can fast-track investment, reduce duplication, and unlock mutual economic and decarbonisation benefits.

Policy Mechanisms and Industry Supports for Green Hydrogen in Australia				
Support	**Type**	**Administered by**	**Purpose**	**Budget**
Hydrogen Headstart (Federal)	Revenue support mechanism	Australian Renewable Energy Agency (ARENA) & Department of Climate Change, Energy, the Environment and Water (DCCEEW) ['DQ']	Provides competitive contracts-for-difference (CfD) to bridge the commercial gap for large-scale renewable hydrogen projects.	$2B AUD (2023–24 Federal Budget)
Future Made in Australia Act (FMIA)	Whole-of-economy industrial policy framework	the Australian Government, led by the Department of the Prime Minister and Cabinet (PM&C)	Seeks to support sovereign manufacturing and clean energy industries including hydrogen, batteries, and critical minerals. Provisions for production incentives, concessional finance, and strategic procurement.	Unconsolidated
National Hydrogen Strategy	Strategic policy framework	DQ in partnership with all state and territory governments through the Energy and Climate Change Ministerial Council (ECMC)	Outlines Australia's ambitions to be a global leader in hydrogen production and export. Revision to reflect updated net-zero, industrial, and trade priorities.	Unconsolidated
Australia–India Critical Minerals Investment Partnership	Bilateral strategic partnership	Australia: • Department of Industry, Science and Resources (DISR) • Supported by Austrade and Export Finance Australia (EFA) • In partnership with the Critical Minerals Office, housed within DISR India: • Ministry of Mines, through KABIL (Khanij Bidesh India Ltd) – a joint venture of NALCO, HCL, and MECL focused on overseas critical minerals acquisition and partnerships	Supports secure, ethical supply chains for critical inputs (e.g. nickel, cobalt) essential to electrolyser and battery manufacturing. Enables green hydrogen sector inputs.	$4 billion (Australia's Critical Minerals Facility)
Clean Energy Finance Corporation (CEFC)	Government-owned green bank	An independent Australian Government-owned statutory authority, reports to the Minister for Climate Change and Energy, currently through DQ	However, these loans are not currently treated as quasi-equity instruments in financial risk assessments or policy frameworks, which limits their catalytic potential to crowd in private capital.	~$380 million committed to hydrogen-related investments
Renewable Hydrogen Deployment Funding Round	Market Activation Mechanism	Australian Renewable Energy Agency (ARENA)	The Renewable Hydrogen Deployment Funding Round aimed to fast-track commercial-scale renewable hydrogen in Australia by supporting large electrolyser projects, lowering costs and risks, and laying the groundwork for future export markets.	$70 million total program funding

Policy Mechanisms and Industry Supports for Green Hydrogen in Australia *(continued)*				
Support	**Type**	**Administered by**	**Purpose**	**Budget**
R&D and commercialisation grants	Early-stage innovation funding	Australian Renewable Energy Agency (ARENA)	To support research, development, and early-stage commercialisation of emerging clean energy technologies—such as renewable hydrogen—by funding projects that: • Advance technical innovation and proof-of-concept • Bridge the gap between lab-scale R&D and commercial viability • De-risk novel solutions and improve cost-competitiveness of hydrogen production, storage, and end-use	Over $200 million committed
Northern Australia Infrastructure Facility (NAIF)	Concessional finance body	an independent statutory body of the Australian Government, operates under the Department of Infrastructure, Transport, Regional Development, Communications and the Arts	Provides loans for enabling infrastructure (e.g. port upgrades, pipelines) for hydrogen projects in northern regions.	A total investment capacity of $7 billion
State-Based Hydrogen Strategies	Land access, feasibility study funding, training programs, and state-level investment attraction.	various State-based government department and authorities	**Western Australia Hydrogen Strategy:** • Focuses on making WA a global clean hydrogen exporter by 2030 **Queensland Hydrogen Industry Strategy (2019–2024):** • Aims to position QLD as a leader in hydrogen production and export, a strong focus on workforce development and regional growth. **South Australia Hydrogen Action Plan (2019):** • Supports hydrogen as a key pillar of SA's clean energy future, with strategic goals around scaling production, blending, and export. Hydrogen hubs, R&D, and electrolyser projects.	• **WA** $160M • **QLD** $100M • **SA** $50M
National Reconstruction Fund (NRF)	Clean energy & advanced manufacturing	National Reconstruction Fund Corporation (NRFC)	Potential support for domestic electrolyser manufacturing, component assembly, and value-added green commodities like HBI.	(up to $15 billion total funding pool)
Australia–India Strategic Research Fund (AISRF)	Research fund	**Australia:** • Department of Industry, Science and Resources (DISR) • In partnership with the Australian Academy of Science for specific programs **India:** • Department of Science and Technology (DST), Government of India	Supports joint R&D in renewables and hydrogen technologies through academic and institutional partnerships. One of Australia's largest bilateral research funds. Supports collaborative research projects, joint workshops, and fellowships Focuses on strategic science and technology priorities, including clean energy, hydrogen, advanced manufacturing, and AI	Over $100 million committed since the fund's establishment in 2006

Policy Mechanisms and Industry Supports for Green Hydrogen in India				
Support	**Type**	**Administered by**	**Purpose**	**Budget**
National Green Hydrogen Mission		Ministry of New and Renewable Energy (MNRE)	India's flagship program to promote green hydrogen production, use, and export; includes demand creation, supply chain development, and pilot projects.	₹19,744 crore (~A$3.6 billion)
Strategic Interventions for Green Hydrogen Transition (SIGHT)		MNRE & SECI (Solar Energy Corporation of India)	Offers production-based incentives for green hydrogen and electrolyser manufacturing to reduce cost and increase scale.	₹17,490 crore (A$3.2B)
PLI Scheme for Electrolysers and Advanced Chemistry Cells		Ministry of Heavy Industries & MNRE	Production-linked incentive scheme to support domestic manufacturing of green hydrogen components (e.g. electrolysers, batteries).	₹4,440 crore (electrolysers only)
India–Australia Strategic Research Fund (AISRF)		DST (India) and DISR (Australia)	Supports collaborative R&D in clean energy, hydrogen, and advanced materials with Australian partners.	> A$100 million (shared bilateral fund)
FAME-II Scheme		Ministry of Heavy Industries	Indirect support mechanism enabling hydrogen mobility through subsidies for fuel cell vehicles and charging infrastructure.	₹10,000 crore (overall, incl. EVs)
Public Sector Mandates (e.g. NTPC, Indian Oil)		Government of India & state-owned enterprises	Government-led procurement and deployment of green hydrogen in refineries, fertiliser production, and transport pilots.	Project-specific (e.g. NTPC: ₹400+ crore)
Renewable Energy Manufacturing Parks		State governments + MNRE support	Establish RE + hydrogen component manufacturing zones, such as in Gujarat, Rajasthan, and Tamil Nadu.	Varies by state – e.g. ₹80B+ investment in Gujarat
International Collaboration Platforms		Ministry of External Affairs + MNRE (e.g. ISA, I2U2, India–Australia H2 MoUs)	Facilitate global partnerships for financing, R&D, and offtake, including with Australia, Germany, UAE, and Japan.	Non-budgetary; diplomatic & financing facilitation

Green hydrogen Supply Chain Scorecard

Methodology for Supply Chain Scorecard Evaluation

The supply chain scorecard uses a developer-informed, location-sensitive approach to assess the viability of green hydrogen deployment in both Australia and India. Rather than relying on national averages - which can misrepresent actual access to enabling infrastructure - developers are asked to score each supply chain segment on a scale of 1 to 5 based on their project-specific satisfaction with cost-effective availability. This approach ensures the analysis reflects real-world barriers and opportunities faced by those delivering projects on the ground.

Each segment—spanning upstream power, hydrogen production, midstream infrastructure, downstream use, and cross-cutting inputs—is assessed against five criteria: domestic capability, policy support, investment pipeline, export readiness, and collaboration potential. By integrating lived industry experience with structured comparative criteria, the scorecard captures not only the technical and economic readiness of each market, but also the systemic enablers and constraints shaping project success.

Segment	Examples/Scope
Upstream Power	Solar PV, Wind, Pumped Hydro
Hydrogen Production	Electrolysers (PEM, Alkaline), Water Supply
Midstream Infrastructure	Compression, Storage, Pipelines
Downstream Use	Fertilisers, Refining, Steel, Export
Cross-Cutting Inputs	Critical Minerals, Skilled Labour, R&D, Finance

Criterion	Description
Domestic Capability	Existing local production/manufacturing strength
Policy Support	Strength of public incentives/regulation
Investment Pipeline	Known projects, MoUs, or public-private partnerships
Export Readiness	Infrastructure and trade agreements for export
Collaboration Potential	Complementarity with other country (Australia ↔ India)

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Green hydrogen Supply Chain Scorecard

Segment	Australia – Score & Notes	India – Score & Notes	Synergy / Collaboration Potential
Upstream Power (Solar PV)	4.5 – Strong deployment, most panels imported	4 – Manufacturing base growing via PLI scheme	India can supply panels for joint H2 projects
Upstream Power (Wind Energy)	4 – Established capacity, esp. offshore R&D	2 – Nascent, mostly onshore	Joint R&D + hybrid RE parks
Upstream Power (Pumped Hydro)	1 – Large-scale plans (Snowy 2.0) not located near green hydrogen projects	4 - India's hydropower is roughly 52.1–52.8 GW	Knowledge transfer
Electrolyser Manufacture	2.5 – Limited local manufacturing	3 – PLI-funded scale-up underway	Joint manufacturing opportunities
Access to Ports / Shipping	3.5 - Established ports, limited H_2 readiness	3 - Existing ports, limited hydrogen adaptation	Joint port upgrades enable export scale.
Storage + Pipelines	2 – Under development	2 – Early stage	Co-investment + standards collaboration
Use in Steel	4.5 – Strong pilots, export-ready potential	4 – Large-scale demand from steel sector	Australia exports H2 or HBI, India consumes
Use in Fertilisers	1.5 – Minor use in Aus	5 – Major ammonia & fertiliser production	Strategic off-take pathways

Stakeholder Engagement Findings

Key Insights from Indian stakeholders

Scaling Green Hydrogen Round Table, New Delhi, March 2025

Key businesses were identified and engaged for the **'Scaling Up India-Australia Partnership for Green Hydrogen Production'** Roundtable held in New Delhi on 26 March 2025.

Indian businesses represented included:
Greenko, ACME, ReNew, FusionX Energy, Sembcorp, Hero Future Energies and Vena Energy.

Stakeholder Insights:

Green hydrogen to green ammonia is an early opportunity, building on the first green ammonia plant at ACME

There is an opportunity to look at collaboration on electrolyser manufacturing and critical minerals like platinum and vanadium

Green hydrogen and ammonia have to traverse the cost curve that solar once took

We can look at carbon pricing, because green hydrogen generates carbon credits which can be exported out of India

We want each country to put $1 Billion on the table to build green ammonia plants - perhaps by providing offtake or tax production credits and building out the supply chains (electrolyser, solar, skills etc)

Water resources are a concern in some areas

Ammonia can be transported and used for shipping, fertiliser, explosives and co-firing in coal power stations

Electrolyser costs are still a challenge, as is the skilled workforce

Off-take certainty is critical to take out volatility and ensure project bankability

Certification (standards) for green hydrogen is still needed

We need to encourage green hydrogen in steel, shipping and heavy vehicles

Australia has tax production credits for green hydrogen and India has the PLN scheme - but we don't have the incentives for green ammonia or green iron

Stakeholder Engagement Findings

Key Insights from Aus-Ind stakeholders & Recommendations

Offtake Certainty is Now the Critical Bottleneck

Projects are increasingly constrained not by technology or capital, but by the lack of long-term offtake agreements—particularly for green hydrogen and derivative products like ammonia and green iron. Without clear certification frameworks and trade-aligned purchase commitments, projects stall before reaching FID.

Recommendation: Prioritise government-backed offtake guarantees or risk-underwriting mechanisms to de-risk early-stage projects and unlock private investment.

Integrated Value Chains Are Emerging

Australia is shifting from raw hydrogen exports toward high-value downstream processing (e.g. mine-to-hydrogen-to-steel). Projects like Progressive Green Solutions highlight the competitive advantage of domestic value-add manufacturing. [m]

Recommendation: Support integrated project models that maximise domestic job creation, energy security, and export resilience.

Global Partnerships are Shaping Strategy

Germany and Japan are key bilateral partners driving Australia's hydrogen agenda—through export credit schemes, port-to-port corridors, and certification alignment. These relationships are defining eligibility for funding and shaping infrastructure priorities.

Recommendation: Deepen technical cooperation and certification harmonisation with trusted partners to avoid trade divergence.

Certification Systems Must Bridge Export Markets

Stakeholders consistently identified the absence of internationally recognised Guarantees of Origin (GO) as a major trade risk. Without harmonised carbon accounting and export-ready certification, Australian producers face non-tariff barriers in the EU, Japan, Korea, and beyond.

Recommendation: Accelerate the development of a legislated Clean Commodity Certification & Trading Platform aligned with global CBAM frameworks.

Infrastructure Investment Must Match Past Energy Booms

Stakeholders noted that the scale of green hydrogen infrastructure support falls short of what was historically mobilised for fossil energy (e.g. entire towns like Collie built around coal).

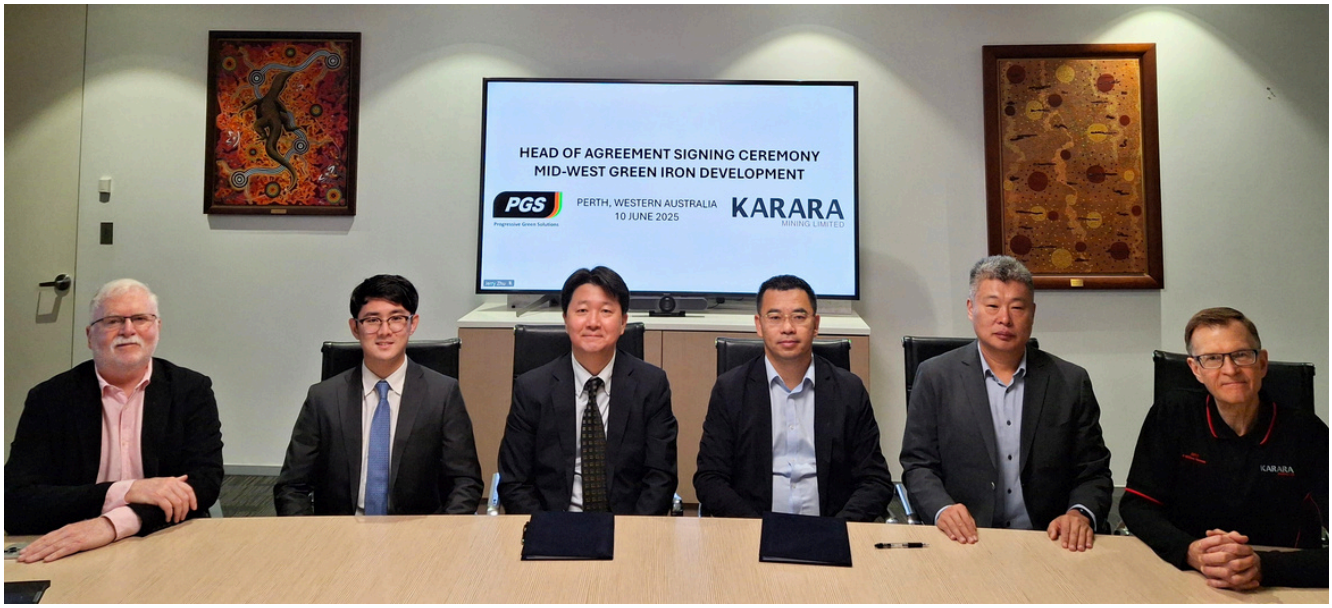
Recommendation: Commit to green industrial precincts with government-led infrastructure support—covering ports, transmission, housing, and workforce development.

WA's Land and Logistics Are Strategic—but Underleveraged

Western Australia's scale, port access, and proximity to Asia make it a natural hub for green commodity exports. But permitting delays, local infrastructure gaps, and lack of national coordination are slowing project timelines. [e]

Recommendation: Fast-track land access approvals and fund common-user infrastructure in WA's key industrial zones.

Progressive Green Solutions: A Case Study in Bilateral Hydrogen Diplomacy Driving Australia's Green Industrial Future



Progressive Green Solutions (PGS) stands as a powerful real-world example of the tangible outcomes emerging from Australia's green hydrogen diplomacy, especially its bilateral trade and decarbonisation cooperation with Germany, Korea, and Japan. Situated in Geraldton, PGS' vertically integrated project, from mine to green iron plant, is on track to become one of Australia's most advanced clean iron and hydrogen hubs. It has already completed feasibility studies, with a final investment decision expected within 12 months, and secured interest from major German financiers, representing over €2.6 billion in potential funding commitments.

This momentum aligns with Australia's broader strategic trade engagements with Germany, Korea, and Japan, three of the world's most advanced economies pursuing hydrogen and green industrial imports [43]. All three are exploring long-term offtake arrangements for green hydrogen and low-carbon materials such as Hot Briquetted Iron (HBI). PGS not only embodies the national ambition to value-add onshore using renewable energy, but also demonstrates how clear offtake interest, coordinated government support (e.g. via the ARENA and the CEFC, and bilateral financing mechanisms can unlock investment at industrial scale.

MID-WEST GREEN IRON PROJECT

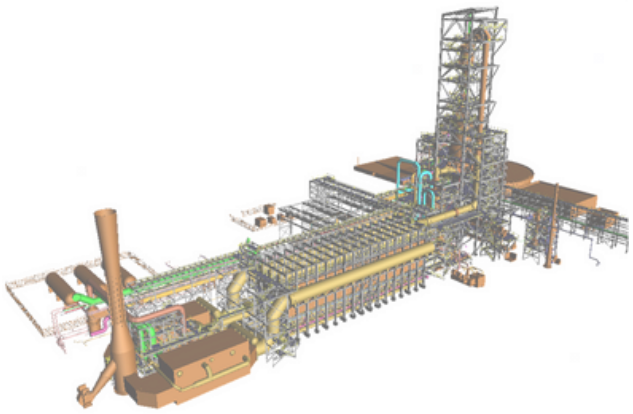
Production goals

30MT

DRI Grade Green Pellets

10MT

Green DRI/HBI



Strategic Collaboration Opportunities

$4B
Australia–India Critical Minerals Investment Partnership [44]

$100M
Australia–India Strategic Research Fund (AISRF) [45]

$46.5B
India–Australia two-way goods and services trade in 2023 [46]

Joint Demonstration Project Proposal

At the India Roundtable, John Grimes proposed a flagship Australia–India collaboration focused on producing green ammonia for use in renewable fertiliser—positioning it as a high-impact demonstration project with global relevance. Designed for announcement at COP31, the initiative would showcase the practical, scalable benefits of bilateral cooperation in decarbonising agriculture and establishing clean commodity value chains.

Advance Global Green Hydrogen Standards

Drive the development of a unified, internationally recognised certification framework through coordinated bilateral and multilateral channels. By aligning on emissions intensity, traceability, and sustainability metrics, Australia and India can enhance market transparency, unlock cross-border trade, and position themselves as rule-makers—rather than rule-takers—in the emerging Indo-Pacific hydrogen economy.

Accelerate Bilateral R&D Collaboration

Deepen joint research and development on next-generation electrolysers and industrial applications—including green fertilisers, green steel, and maritime fuels. Leverage platforms such as the Australia–India Strategic Research Fund (AISRF) to drive cost reductions, enhance technical interoperability, and fast-track commercial deployment across priority sectors.

Policy Recommendations

Establish a Price Floor/Ceiling Mechanism for Green Commodities

POLICY GOLD STANDARD

A price floor/ceiling mechanism—modelled on a Contract-for-Difference (CfD) — guarantees producers a minimum return (floor) while capping windfall profits (ceiling), with the government covering shortfalls or reclaiming excess. This derisks investment, enables project bankability, and sends strong market signals without distorting competition. Considered a global "gold standard" in clean energy policy, CfDs have driven offshore wind in the UK and are increasingly being adapted for clean industrial commodities [47]. A bilateral approach to CfD-style support could build resilience across hydrogen, green ammonia, and green iron markets in the Indo-Pacific.

Australia

Australia's closest equivalent to a Contract-for-Difference (CfD) is the Hydrogen Headstart program, which acts as a stabiliser for early-stage hydrogen producers [48]. Rather than locking in a price band, it provides production-linked revenue support to bridge the cost gap between green hydrogen and fossil fuels. It functions much like a set of training wheels—helping the sector stay upright during its formative phase—but it falls short of offering the long-term market certainty that a full CfD provides. With limited scale, budget, and duration, Hydrogen Headstart currently supports only a handful of flagship projects and does not yet constitute systemic price architecture. Notably, Australian green hydrogen developers have ranked the need for a formal floor/ceiling mechanism as a top priority—scoring it 95 out of 100—underscoring the urgency of establishing a more robust, investment-grade market signal.

India

India's National Green Hydrogen Mission (NGHM) and SIGHT program offer capital and cost-reduction incentives, but do not yet include structured price guarantees [49]. The absence of a clear floor/ceiling model limits long-term market certainty, especially for export-oriented or high-capex projects like electrolyser scaling or green steel. India's proposed CfDs are closer to offtake support guarantees rather than fixed-price strike mechanisms [50].

STRATEGIC COLLABORATION POTENTIAL

India and Australia both recognise the importance of investment certainty but approach it through different tools—capital incentives in India and revenue support in Australia. A joint taskforce could co-design Indo-Pacific CfD frameworks tailored to hydrogen and derivatives, enabling coordinated export readiness, de-risked bilateral offtake, and shared learnings on implementation.

POLICY GOLD STANDARD

Include Green Iron and HBI in Production Incentive Frameworks

Incorporating green iron and hot briquetted iron (HBI) into national production incentive frameworks—such as tax credits, CfDs, or hydrogen-linked subsidies—ensures downstream value-added manufacturing receives the same support as hydrogen production. This "gold standard" approach unlocks strategic co-benefits across emissions reduction, industrial decarbonisation, and trade competitiveness. Mirroring the US Inflation Reduction Act [51], which ties hydrogen incentives to domestic manufacturing outcomes, this model aligns public support across the full value chain—de-risking investment, building sovereign supply capacity, and improving the global competitiveness of clean commodity exports.

Australia

The Future Made in Australia Act identifies green metals as a national priority, with initial funding focused on upstream and midstream development [52]. However, specific production-linked incentives for green iron and hot briquetted iron (HBI) have yet to be defined, creating ongoing uncertainty for potential investors. Additionally, feedback from Australian developers has questioned whether a flat $2 per kilogram production tax credit is appropriate in the early stages of market development. A more effective approach may involve a declining per-kilogram subsidy that adjusts as production scales and costs fall.

Stakeholder consultation with Australian green hydrogen developers revealed strong support for targeted policy measures—scoring this need at 90/100 [53]. This sends a clear signal: unlocking capital for green iron projects requires more than high-level ambition. It demands specific, bankable incentives that integrate the value chain, reduce first-mover disadvantage, and position Australia as a global leader in clean industrial exports.

India

The National Green Hydrogen Mission (NGHM) supports pilot projects focused on green hydrogen use in the steel sector [54]. While these initiatives indicate momentum, India has yet to implement targeted production incentives for green iron or HBI. Existing support mechanisms largely prioritise upstream hydrogen production, with downstream integration policies still under development.

Scoring reflects stakeholder feedback, regulatory completeness, and comparative international benchmarks (e.g. CBAM readiness, developer sentiment, and policy maturity) [55].

POLICY GOLD STANDARD

Legislate and Fund a Clean Commodity Certification and Trading Platform

A legislated, government-backed Clean Commodity Certification and Trading Platform would establish trusted, verifiable standards for low-emissions products—such as green hydrogen, ammonia, and iron—while enabling transparent, real-time pricing through a centralised digital marketplace [56]. This "gold standard" model integrates legally enforceable carbon intensity certification with tradable instruments, reducing market fragmentation and enhancing interoperability with global frameworks like CBAM. By embedding carbon integrity into the core of commodity value, it transforms emissions data from a reporting obligation into a competitive advantage—building investor confidence, attracting international offtakers, and accelerating market formation.

Australia

The 2024 National Hydrogen Strategy highlights the urgency of establishing robust certification and trade alignment mechanisms. However, a formal Clean Commodities Trading Platform has yet to materialise. The proposed Clean Commodities Trading Initiative (CCTI) — rated 90/100 by Australian developers in terms of perceived value and urgency — remains in the concept phase, lacking legislative or regulatory foundation.

In Australia's current political climate, where energy policy has become increasingly weaponised, long-term industrial investments are exposed to policy reversals with each election cycle. This undermines Australia's ability to attract the 10–15 year capital required for green hydrogen and downstream manufacturing.

India

A well-designed CCTI offers a potential circuit-breaker: by embedding climate-linked value into financial contracts — rather than legislation alone — it imposes real exit costs on governments that attempt to unwind agreements. This contractual durability creates investor confidence. By delivering price transparency, carbon integrity, and credit resale options, the CCTI could elevate Australia as a credible, future-proof trading partner and global clean export markets.

India's Ministry of New and Renewable Energy (MNRE) has introduced national standards for green hydrogen and is progressing certification frameworks [57]. There are active efforts to establish a single-window clearance system and streamline verification protocols. However, a comprehensive commodity trading platform-linking certification to price discovery and cross-border trade - is not yet in place.

POLICY IN ACTION

CASE STUDY
Clean Commodity Trading Initiative

How the Clean Commodity Trading Initiative could accelerate Project YURI, deliver price certainty for Australian farmers, and position Australia as a global leader in food-secure, low-emissions production.

Project yuri:
Green ammonia

Production goals

640 T

green hydrogen per annum [58]

0.04%

of current hydrogen demand that will be 'green'

ABOUT THE PROJECT

Project Yuri is a pioneering green hydrogen initiative in Western Australia, led by ENGIE and Mitsui, with Yara Pilbara Fertilisers as offtaker. With support from ARENA and the CEFC, the project will use a 10 MW electrolyser powered by an 18 MW solar PV array and an 8 MW battery to produce renewable hydrogen for low-carbon ammonia at Yara's Karratha plant [60]. As one of Australia's first integrated hydrogen projects at commercial scale, Project Yuri aims aims to decarbonise ammonia production

THE CRUX OF THE CHALLENGE

A huge amount of land would be required for Project Yuri to scale renewable energy infrastructure to the point where green hydrogen constitutes the majority of total hydrogen input. While there is no shortage of land in the broader Pilbara region, no further development is permitted on Murujuga, and future expansion would require securing vast land areas elsewhere, potentially near Maitland. And that's just the spatial challenge—before factoring in cost, resource availability, and deployment constraints.

Putting 'National interest PRICE' on Strategic externalities relating to food security

Over the past two decades, fertiliser prices in Australia have experienced substantial fluctuations. For instance, the price of Diammonium Phosphate (DAP) rose from approximately AUD 400 per metric ton in early 2020 to over AUD 1,200 by March 2022, before declining to around AUD 850 by late 2024 [61]. Such volatility can strain farm budgets and affect planting decisions.

Simultaneously, farm incomes have shown considerable variability. In the 2023–24 financial year, average farm cash income for specialist cropping farms is estimated to have decreased by 53% to AUD 427,000 per farm, which is 27% below the average in real terms for the 10 years to 2022–23 . This decline underscores the sensitivity of farm profitability to input costs and market conditions [64].

The combination of high fertiliser costs and declining farm incomes poses a threat to the competitiveness and sustainability of Australian agriculture. Without access to affordable fertilisers, farmers may reduce application rates, leading to lower crop yields and quality. This scenario could compromise Australia's food security and its position in global agricultural markets.

AUSTRALIAN AGRI

by numbers

$82.5B

gross value of agricultural production in 2023–24 [62]

6%

Australian GDP derived from food production sector [63]

There are likely hidden financial gains for the Australian Economy that could be extracted from supporting projects like Yuri.

CASE STUDY
Clean Commodity Trading Initiative (contd.)

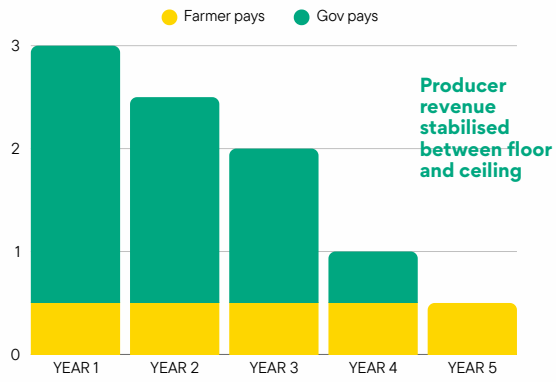
HOW COULD THE CLEAN COMMODITY TRADING INITIATIVE WORK?

Australian Government could set the following contract terms:

1MT GREEN AMMONIA FERTILIZER EACH YEAR FOR FIVE (5) YEARS [65]

$0.5 PER KG GREEN AMMONIA FERTILIZER CONTRACTED UNIT PRICE [66]
for Australian farmers under an approved supplier arrangement

$1.9 PER KG GREEN AMMONIA FERTILIZER AVERAGED CONTRACTED UNIT PRICE [67]
the Australian government pays for Green ammonia across five years



The shaded yellow portion represents clean commodity credits purchased by the government at the floor price. These credits are retained for future resale when prices exceed the ceiling. This ensures price stability for producers without constituting a permanent subsidy - support is recoverable, preserving fiscal responsibility while catalysing investment.

How would this government contract change things for project Yuri?

- a market-balancing instrument with eventual government resale of credits
- provides Australian farmers price stability for a major cost input for the next (x) years
- Strengthens national food security by reducing dependence on volatile international fertiliser markets and ensuring a stable, sovereign supply of ammonia critical for Australian crop yields.

Offer Concessional Loans Treated as Equity

POLICY GOLD STANDARD

This policy enables governments to catalyse private capital by issuing concessional loans with equity-like features—such as long tenors, low or deferred interest, and back-ended repayments—without diluting project ownership. These quasi-equity instruments enhance bankability by improving balance sheet strength and reducing early-stage risk.

Deployed by institutions like Germany's KfW and Australia's CEFC, this approach is proven to accelerate investment in capital-intensive industries such as green hydrogen [68]. By signalling policy certainty and unlocking investor confidence, it allows final investment decisions (FIDs) to proceed with greater speed and scale.

Australia

The Clean Energy Finance Corporation (CEFC) has committed an additional $20.5 billion to support Australia's clean energy transition, including targeted investment in green hydrogen. Concessional finance—especially long-tenor, low-interest loans—remains critical to closing early-stage capital gaps [69]. However, these loans are not currently treated as quasi-equity instruments in financial risk assessments or policy frameworks, which limits their catalytic potential to crowd in private capital [70].

Feedback from Australian developers indicates strong demand for financial tools that improve bankability and reduce risk. Aligning concessional capital with international best practice could unlock significantly more private investment and accelerate market deployment.

Despite availability, concessional loans in Australia are not yet structured or perceived by the market as quasi-equity instruments, limiting their effectiveness in de-risking early-stage investment.

India

India's National Green Hydrogen Mission (NGHM) and related schemes offer concessional capital and subsidies, but concessional loans structured as quasi-equity are not yet a formalised instrument in green hydrogen project finance [71]. Integration of this mechanism—especially via blended finance platforms—would enhance capital efficiency and reduce investor risk.

STRATEGIC COLLABORATION POTENTIAL

Both countries are pursuing concessional finance, but lack alignment on structuring loans as quasi-equity. Strategic collaboration could include sharing CEFC expertise, building financial capacity in India, and co-designing blended finance tools. Short-term potential is modest, but could grow if India adopts equity-like instruments [72].

POLICY GOLD STANDARD

Fund Feasibility & FEED Studies at 50% Cost Share

This policy offers matched funding for early-stage Feasibility and Front-End Engineering Design (FEED) studies—covering 50% of eligible costs for green hydrogen and clean commodity projects. As a globally recognised "gold standard" intervention, this model reduces upfront financial barriers, accelerates project readiness, and builds a pipeline of de-risked, investable opportunities without crowding out private sector initiative [73]. Widely adopted in EU programs and supported by international finance institutions, this approach ensures that public funds catalyse—not replace—private capital formation [74].

Australia

The Australian Renewable Energy Agency (ARENA) continues to fund feasibility and FEED studies, and while the 50% cost-share model is not universal, it is broadly supported across industry [75]. Stakeholder feedback indicates that more consistent access to this model would further accelerate project pipelines and de-risk investment decisions.

India

Under the National Green Hydrogen Mission (NGHM), India supports pilot projects and R&D initiatives, which may include feasibility studies. However, cost-sharing arrangements are currently ad hoc and determined on a case-by-case basis, limiting predictability and replicability [76].

STRATEGIC COLLABORATION POTENTIAL

This area offers moderate strategic alignment potential. Australia brings valuable programmatic experience through ARENA's approach to cost-shared feasibility and FEED studies, which could inform India's efforts to formalise its own model [77]. Knowledge exchange, particularly around standardised funding frameworks, due diligence processes, and early-stage project de-risking, could help India scale high-impact hydrogen projects faster. Over time, co-financing feasibility studies for joint ventures or cross-border value chains may serve as a practical stepping stone toward deeper bilateral green hydrogen cooperation.

Develop Legal & Trade Instruments to Anchor an Asian CBAM

Leverage trade agreements and regional cooperation to establish enforceable, transparent legal mechanisms for a Carbon Border Adjustment Mechanism (CBAM) in the Indo-Pacific. This includes aligning carbon accounting methodologies, embedding carbon standards into bilateral agreements like CECA and AI-ECTA, and supporting multilateral forums to coordinate implementation. As outlined in CEF's "A Price on Carbon: Building Towards an Asian CBAM" (2025) [78], this gold-standard approach strengthens carbon integrity, rewards clean production, and positions Australia and India as rule-shapers in global green trade. [79]

POLICY GOLD STANDARD

Australia

Australia recognises the importance of international certification and trade alignment—most notably through the National Hydrogen Strategy and bilateral agreements such as AI-ECTA [80]. However, it currently lacks a formalised approach to implementing a Carbon Border Adjustment Mechanism (CBAM) adapted to the Asian region. The absence of legislative measures to embed carbon pricing into export frameworks or harmonise product carbon standards constrains Australia's credibility as a CBAM frontrunner [81]. Notably, green hydrogen industry stakeholders have placed relatively low urgency on this issue, reflecting either limited awareness or confidence in alternative pathways. Nonetheless, there remains a strategic opportunity for Australia to assume a leadership role in shaping regional trade standards—particularly if aligned with future-facing reforms under the *Future Made in Australia Act* [82].

India

India has made significant progress on market mechanisms, including plans to shift from energy efficiency targets to intensity-based carbon metrics. It is also laying the groundwork for a national carbon market and has shown willingness to engage in international carbon pricing discussions [83]. However, India does not yet have a formal CBAM strategy and has not articulated a regional leadership agenda specific to the Asian context. Still, its growing domestic policy maturity offers a foundation to become a key player in regional carbon trade negotiations.

STRATEGIC COLLABORATION POTENTIAL

Developing a regional CBAM could take up to a decade, during which India and China are likely to advance carbon pricing and market systems—positioning them to shape Asian trade norms [84]. Australia, with strong regional ties and regulatory credibility, is well-placed to act as a bridge-builder. Early alignment with India on certification, transparency, and decarbonisation can amplify shared influence and reduce future trade friction [86].

POLICY GOLD STANDARD

Create a Strategic Export Incentive for Indo-Pacific Green Hydrogen Supply

A Strategic Export Incentive is essential to ensure green hydrogen and its derivatives remain globally competitive in fast-growing Indo-Pacific markets. This “gold standard” approach—seen in export models like Japan’s JOGMEC and Korea’s KEXIM—provides targeted financial support (e.g. rebates, tax credits, concessional offtake guarantees) to de-risk international transactions and enable long-term supply agreements [87].

By embedding these tools within trade and investment diplomacy, Australia and India can position themselves as anchor suppliers in a decarbonising Asia. Aligning export incentives with regional energy security needs not only enhances cross-border offtake certainty, but also amplifies domestic industrial value-add, job creation, and emissions impact.

Australia

Australia’s 2024 National Hydrogen Strategy commits to an ambitious export target—200,000 tonnes by 2030, scaling to 1.2 million tonnes [88]. However, there are no dedicated export incentives tailored to Indo-Pacific markets. Developers rate this as a high-impact policy gap, especially given competition from better-incentivised jurisdictions [89].

India

India’s NGHM sets a strong export ambition and outlines supportive strategies. However, there are no defined financial instruments to reduce market entry risk for Indo-Pacific offtake. Stronger bilateral coordination (e.g. with ASEAN, Japan, Australia) could help bridge this gap [90].

STRATEGIC COLLABORATION POTENTIAL

Australia and India both aim to lead green hydrogen exports but lack tailored incentives for Indo-Pacific markets. Coordinating export credit tools and trade diplomacy could de-risk offtake, strengthen certification alignment, and establish a joint green hydrogen supply corridor—boosting regional influence and buyer confidence.

Strategic Placement of Government Support

Matching Mechanisms to Value and Advantage

To ensure public investment delivers maximum strategic and economic return, policy mechanisms must be calibrated to two key variables:

1. **Strategic value** — either to Australian industry (commercial viability) or to the Australian government (climate, trade, or sovereign objectives)
2. **Australia's competitive position** — whether we have an inherent advantage or are at a structural disadvantage in global markets

The matrix on page 29 maps a suite of policy tools—including production incentives, concessional finance, cost-sharing for early-stage development, and export enablers—against these axes. It demonstrates how funding and subsidy mechanisms should be differentiated based on the commercial maturity of the technology, the strategic importance of the application, and the likelihood of long-term competitiveness. In this report, Australia as a jurisdiction has been accessed, but the same framework of thinking can should should be applied in the Indian context (and could be included in future reports).

Key insights:

- Minimal or short-term support should target areas where the market can drive progress, but an initial kick-start may accelerate cost reductions or enable system-wide benefits.

- Durable, long-term mechanisms (like certification platforms and export incentives) are essential where public value is highest—particularly in supporting regional trade, climate commitments, and industrial resilience.

- Public finance should avoid propping up uncompetitive ventures and instead crowd in capital for projects with clear pathways to commercial viability.

This approach ensures that taxpayer ROI is maximised, industry receives the right signals, and Australia's role in global green value chains is grounded in competitive strength—not subsidy dependence.

FRAMING AUSTRALIA'S GREEN INDUSTRIAL INVESTMENT: STRATEGIC VALUE AND SMART SUBSIDY DESIGN

Rather than making absolute judgments on individual projects or technologies, this approach aims to match support mechanisms to the maturity, strategic alignment, and commercial profile of different opportunities.

APPLYING THE FRAMEWORK: SECTOR INSIGHTS

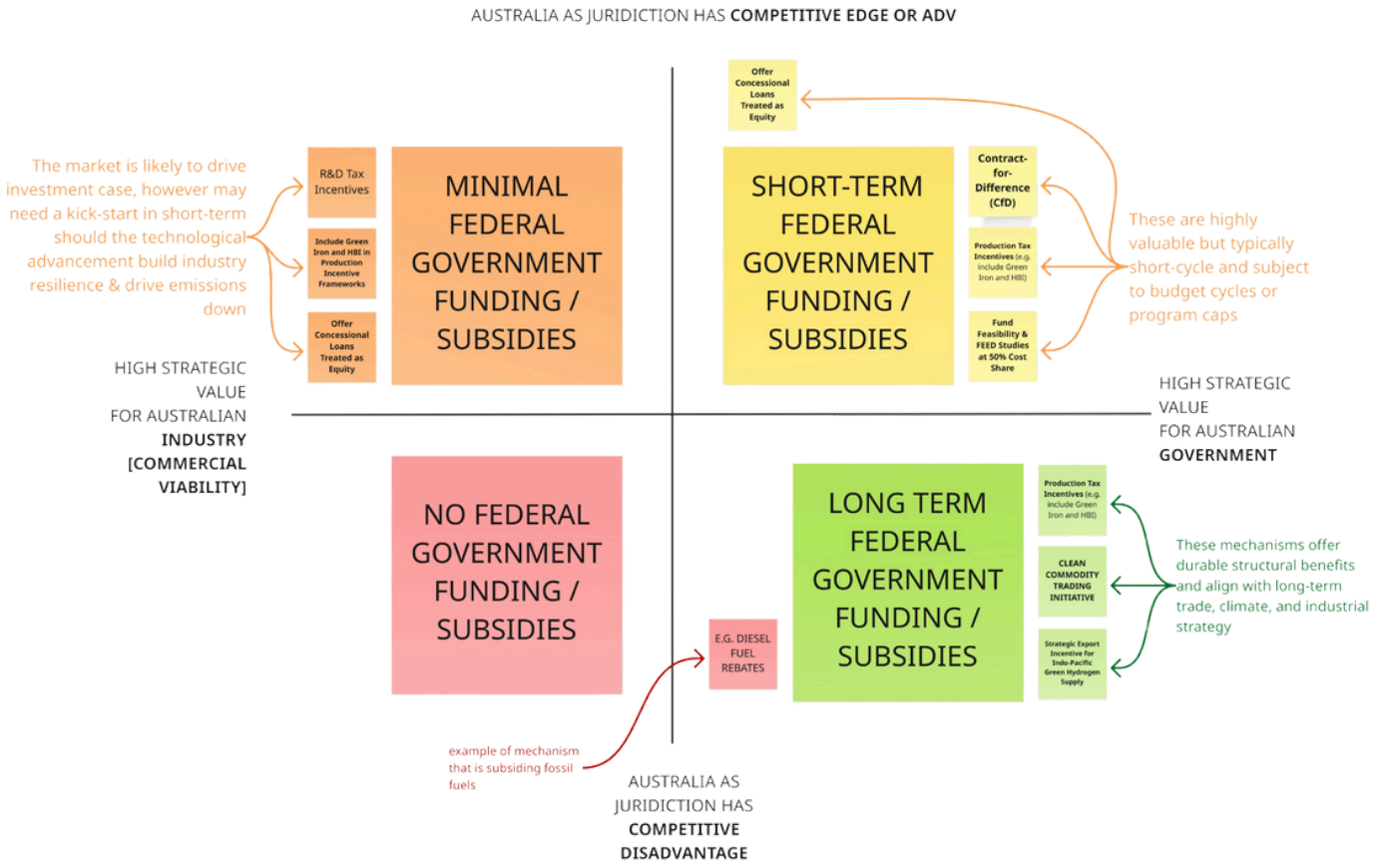
Green Iron Production (Hematite and Magnetite)

- Both pathways offer major decarbonisation potential, but they vary in maturity and cost profile.

- **Hematite-based green iron** benefits from Australia's global leadership in hematite reserves, extraction capability, and innovation ecosystem. It is well positioned to scale with limited but catalytic government support—especially via production incentives or equity-style concessional finance [91].
- **Magnetite-based green iron** presents higher energy & processing costs, requiring short-term public co-investment to demonstrate viability [92].

Strategic Placement of Government Support

Matching Mechanisms to Value and Advantage



Mechanisms like Contract-for-Difference or cost-share feasibility funding can help unlock early deployment, but support should taper as commercial models firm up [93].

Green Ammonia Production

- Green ammonia is highly sensitive to scale, proximity to ports, and offtake certainty. Its viability hinges on achieving globally competitive costs through:
  - Large-scale renewable energy access,
  - Efficient infrastructure siting, and
  - Reliable export demand and long-term offtake [94].

- India – Australia collaboration presents an outsized opportunity in this space. India's energy security and fertiliser demand create a structurally growing market for green ammonia. Australia can play a critical role in early-stage production, but in the medium-to-long term, cost competitiveness may shift toward Indian co-manufacturing due to demand scale and industrial policy advantages [95].

- This is why concessional loans with equity-style terms are a smart mechanism:
  - If private investors are on the hook for repayment, they will only co-invest in projects with a clear commercial path—ensuring public capital is aligned with market due diligence and avoiding stranded assets or subsidy leakage.

Converting Agreements into Green Hydrogen Growth

Baseline Assessment: Leveraging Existing Agreements

This baseline assessment explores how bilateral and regional agreements can be activated to catalyse joint green hydrogen deployment between India and Australia. It reviews foundational instruments such as the Australia–India Economic Cooperation and Trade Agreement (AI-ECTA), the evolving Comprehensive Economic Cooperation Agreement (CECA), the Critical Minerals Investment Partnership, and the Strategic Research Fund [96]. It also considers enabling frameworks including the Letter of Intent on Renewable Energy, the Bilateral Renewable Energy Partnership, the Solar and Green Hydrogen Taskforce, and the QUAD Clean Energy Supply Chain Principles [97].

While these agreements establish strong diplomatic intent, they remain underleveraged for industrial coordination. Reframing them as vehicles for co-investment, certification harmonisation, and technology co-development would allow both nations to move beyond high-level frameworks and deliver tangible, system-level progress on hydrogen manufacturing, financing, and trade.

Australia–India Strategic Research Fund (AISRF)

The Australia–India Strategic Research Fund (AISRF)—Australia's largest bilateral research collaboration program—has the potential to evolve into a cornerstone of joint green hydrogen industrial development. While historically focused on academic partnerships, AISRF remains underleveraged as a vehicle for targeted, deployment-oriented innovation [98]. Aligning its future rounds with supply chain priorities identified in this report—such as low-cost electrolyser manufacturing, certification technologies, and green iron production—would strengthen its role as the R&D engine of a shared industrial strategy. Embedding AISRF within a broader investment and trade ecosystem would ensure research translates into commercial outcomes that support both nations' decarbonisation and export goals.

How AISRF Could Drive Green Hydrogen Collaboration

Support Joint Research in Electrolyser Efficiency and Localisation

AISRF can be strategically repositioned to fund bilateral R&D programs focused on context-specific electrolyser technologies—such as high-efficiency PEM units optimised for Australia's off-grid and mining applications, and affordable, scalable alkaline systems suited to India's mass-market deployment needs. Targeted innovation in these areas directly supports both nations' industrial strategies by lowering the levelised cost of hydrogen (LCOH), reducing import dependence, and fostering local manufacturing ecosystems. Aligning AISRF with commercially relevant outcomes will accelerate technology readiness, enhance supply chain resilience, and unlock joint trade and export opportunities.

Accelerate Materials Innovation and Critical Mineral Substitution

AISRF could be repositioned to support bilateral research consortia dedicated to solving material bottlenecks in the hydrogen value chain.

Priority areas include reducing reliance on scarce and expensive catalysts like iridium and platinum, developing scalable recycling processes for electrolyser and fuel cell components, and advancing next-generation hydrogen carriers (e.g. ammonia cracking, LOHCs). These innovations would strengthen value-chain integration between Australia's upstream mineral supply and India's downstream manufacturing strengths—laying the groundwork for a resilient, low-cost hydrogen ecosystem and creating co-benefits across both domestic and export markets.

De-risk Supply Chains through Technology Co-Development

AISRF-backed collaboration could target the co-development of enabling technologies that enhance trust, efficiency, and interoperability across Australia–India hydrogen supply chains. Priority areas include digital twin platforms for asset traceability, grid-integration models to optimise variable renewable inputs, robust safety systems, and certifiable carbon accounting tools. These technologies are essential for underpinning credible trade under frameworks like CECA and AI-ECTA, while also supporting the report's broader recommendation to align technical standards and accelerate the formation of a transparent, rules-based green hydrogen market across the Indo-Pacific.

Foster Next-Gen Talent Pipelines and Mobility

Expanding AISRF to include PhD fellowships, industry secondments, and short-term technical exchanges in green hydrogen fields would help build a skilled, mobile workforce capable of supporting both nations' clean energy ambitions. Such programs would strengthen bilateral institutional ties, harmonise technical competencies, and accelerate knowledge transfer—key enablers for scaling interoperable, export-aligned hydrogen systems. Aligning this talent investment with shared industrial priorities would elevate AISRF from a diplomatic initiative to a strategic engine of joint green hydrogen leadership [99].

Quad Statement of Principles on Clean Energy Supply Chains in the Indo-Pacific

Quad Principles on Clean Energy Supply Chains: A Bilateral Accelerator

The QUAD Statement of Principles on Clean Energy Supply Chains provides a strategic multilateral anchor that India and Australia can operationalise through bilateral action. Its emphasis on resilience, transparency, standards harmonisation, and co-investment directly complements the priorities outlined in the DFAT India Economic Roadmap and both nations' national hydrogen strategies [100]. However, the QUAD clean energy commitments are non-binding principles intended to guide multilateral alignment rather than enforceable obligations

Operationalising QUAD to Strengthen Bilateral Supply Chains

The QUAD's mandate to reduce overreliance on concentrated supply chains aligns with the urgent need to diversify critical inputs—particularly for hydrogen technologies. Australia's resource depth and India's manufacturing scale offer a natural synergy. Under this framework, the two nations can:

- Jointly develop ethical, traceable supply chains for inputs such as nickel, vanadium, and rare earths.
- Accelerate electrolyser localisation through harmonised sourcing and investment, supported by the Australia–India Critical Minerals Investment Partnership (CMIP).

This approach transforms high-level principles into tangible bilateral outcomes—building foundational infrastructure for an integrated hydrogen export market across the Indo-Pacific.

Advance Aligned Standards & Certification for Hydrogen Trade

The QUAD's emphasis on interoperable standards provides a powerful platform for India and Australia to co-develop harmonised certification frameworks that reduce trade friction and accelerate market formation. Bilateral action could include:

- Aligning hydrogen Guarantees of Origin (GO) to ensure traceable, verifiable exports across both jurisdictions.
- Establishing mutual recognition of carbon intensity methodologies to simplify regulatory compliance and boost investor confidence.
- Positioning Indo-Pacific-developed standards as regional benchmarks—pre-empting fragmentation and strengthening the competitiveness of Australian and Indian exports in global markets.

By embedding shared certification protocols into broader QUAD objectives, India and Australia can shape a rules-based hydrogen market that favours transparent, high-integrity producers.

Enable QUAD-Aligned Financing and Co-Investment Pathways

The QUAD promotes shared investment in strategic clean energy infrastructure. India and Australia could co-apply or align with QUAD initiatives to:

- Secure co-funding for cross-border hydrogen pilots and value-chain infrastructure (e.g. port hydrogen hubs, ammonia bunkering).
- Support innovation zones or Special Economic Zones (SEZs) for hydrogen technology through pooled multilateral capital.

Support Workforce and Innovation Alignment

Building on QUAD's emphasis on skills development and innovation, India and Australia can advance bilateral competitiveness by:

- Co-developing hydrogen workforce training programs focused on operations, safety protocols, and systems engineering—targeting deployment readiness across both nations.
- Establishing joint R&D platforms under the Australia–India Strategic Research Fund (AISRF), with a focus on next-generation hydrogen production, storage, and integration technologies.

This alignment strengthens both countries' technical ecosystems while embedding shared standards and capabilities critical for scaling green hydrogen supply chains across the Indo-Pacific.

The QUAD's clean energy principles offer India and Australia a strategic multilateral scaffold to elevate bilateral hydrogen cooperation into a broader regional vision. By aligning national hydrogen strategies with QUAD pillars—resilience, transparency, and interoperability—both nations can:

- Embed green hydrogen supply chains into trusted Indo-Pacific networks.
- De-risk cross-border deployment through common standards and co-investment.
- Position themselves as joint architects of the region's clean energy architecture.

This approach transforms bilateral ambition into regional leadership—anchored in shared values and scalable market design.

India–Australia Letter of Intent on New and Renewable Energy Technology

Signed in 2022, the India–Australia Letter of Intent (LoI) on New and Renewable Energy Technology offers a strategic anchor to deepen collaboration on green hydrogen [101]. Though non-binding, it establishes the political trust and institutional scaffolding needed to activate joint action. The LoI can now be operationalised to:

- Align industrial policy and accelerate technology localisation;
- Support joint R&D and manufacturing under existing instruments like AISRF; and
- Convert diplomatic goodwill into co-investment pathways that unlock project deployment.

By leveraging this intent within a structured implementation agenda, the LoI becomes a launchpad for scalable bilateral action across the green hydrogen value chain.

Leveraging the Letter of Intent for Green Hydrogen Acceleration

Catalyse Institutional Partnerships and Bilateral Innovation Tracks

The LoI provides a timely platform to convert diplomatic alignment into high-impact industrial cooperation. It can be leveraged to formalise joint research pipelines and bilateral pilot programs in priority areas such as:

- Electrolyser design optimised for low-cost, high-temperature environments;
- Integrated solar-PV and hydrogen production systems suited to remote or distributed applications;
- Co-development of hydrogen derivatives like methanol and ammonia with export potential.

Anchoring these initiatives through AISRF would align government intent with practical pathways for commercial readiness and regional competitiveness.

Enable Technology Demonstration Projects Across Shared Focus Areas

The LoI offers a practical channel to fast-track real-world demonstration projects that align with mutual industrial priorities. Opportunities include:

- Renewable-powered hydrogen hubs that combine Australian renewable generation with Indian-manufactured electrolysers;
- Piloting Indian electrolyser technologies in Australian industrial zones such as Kwinana or Whyalla to validate performance and accelerate market entry;
- Deploying integrated solar-hydrogen systems to decarbonise mining operations and regional transport corridors.

These demonstrations can be de-risked through coordinated public investment—leveraging ARENA and India's National Green Hydrogen Mission—and structured within CECA or Critical Minerals Investment Partnership (CMIP) trade frameworks to enhance long-term scalability.

Align Policy and Regulatory Frameworks for Market Activation

The LoI provides a strategic umbrella to initiate regulatory harmonisation between Australia and India. Key alignment opportunities include:

- Developing compatible hydrogen safety standards and codes;
- Establishing mutual lifecycle emissions methodologies for Guarantees of Origin;
- Streamlining bilateral IP approvals, JV structures, and equipment testing protocols.

These reforms are foundational to reducing market entry barriers, improving investor confidence, and enabling seamless hydrogen trade. While not a delivery mechanism itself, the LoI can be leveraged to coordinate high-impact actions across research, regulation, and deployment—accelerating industrial growth and positioning both countries as rule-shapers in the Indo-Pacific green hydrogen economy.

Bilateral 'Renewable Energy Partnership'; and actions arising from Solar and Green Hydrogen Task Force

The 2022 India–Australia Renewable Energy Partnership, together with the Solar and Green Hydrogen Task Force, provides a high-impact bilateral platform for translating policy intent into industrial outcomes [102]. While the Partnership defines shared strategic direction, the Task Force will be tasked with delivering actionable recommendations to drive collaboration in hydrogen manufacturing, trade, and deployment. This structure offers a pathway to synchronise standards, co-develop supply chains, and unlock joint investment—supporting the broader objectives of both nations' hydrogen strategies and the recommendations outlined in this report.

Driving Green Hydrogen Collaboration through the Renewable Energy Partnership and Task Force

Align Strategic Planning and Investment Priorities

The Partnership offers a formal mechanism to coordinate bilateral priorities, enabling:

- Alignment of investment pipelines in solar-linked hydrogen production and value chain infrastructure;
- Project matchmaking between Australian developers and Indian manufacturers and offtakers;
- Joint planning of large-scale renewable energy zones to underpin hydrogen exports.

This coordination strengthens the impact of trade frameworks like AI-ECTA and CECA—translating diplomatic agreements into investable projects.

Accelerate Joint Ventures in Electrolyser Manufacturing and Project Deployment

The India–Australia Green Hydrogen Taskforce offers a platform to advance high-impact initiatives,

While formal recommendations from the Taskforce are pending, these priority areas have been signalled through joint announcements and stakeholder engagement. The broader Renewable Energy Partnership provides the structure to formalise, finance, and operationalise such initiatives—enabling a shift from diplomatic alignment to industrial execution.

Coordinate Policy Frameworks and Trade Standards

The Partnership and Task Force offer a critical platform to:

- Align safety regulations, carbon intensity benchmarks, and infrastructure classifications for hydrogen projects;
- Harmonise certification schemes and Guarantees of Origin to ensure interoperability in emerging hydrogen trade;
- Explore cross-border recognition of emissions reductions, enabling bilateral crediting and offset frameworks.

The India–Australia Renewable Energy Partnership and the Solar and Green Hydrogen Taskforce represent the most structured and forward-leaning bilateral mechanisms for advancing green hydrogen collaboration. By embedding shared strategic priorities within institutional frameworks, these platforms enable commercial and technological alignment, facilitate policy and certification harmonisation, and support deeper public–private engagement. While Taskforce outcomes are still forthcoming, their formation signals a joint commitment to move from diplomatic intent to coordinated industrial action—laying the groundwork for a connected, export-capable hydrogen economy across both nations.

Australia–India Economic Cooperation and Trade Agreement (AI-ECTA)

The Australia–India Economic Cooperation and Trade Agreement (AI-ECTA) remains an underleveraged tool for enabling green hydrogen collaboration [103]. With targeted expansion—such as incorporating joint rules of origin for clean hydrogen products, preferential tariffs for certified green commodities, and harmonised treatment of financing and certification frameworks—AI-ECTA could serve as a pivotal platform for aligning trade architecture with decarbonisation goals, accelerating bilateral hydrogen manufacturing, deployment, and export integration across the Indo-Pacific.

Harnessing AI-ECTA to Build a Transnational Green Hydrogen Economy

Facilitate Co-Manufacturing and Supply Chain Integration

AI-ECTA can be a powerful instrument for enabling joint manufacturing across the green hydrogen value chain—from electrolysers to

storage and fuel cell systems. India's scalable manufacturing capacity and Australia's critical minerals and renewables base offer natural complementarities. Through AI-ECTA, both nations can:

- Remove tariffs on key hydrogen-related components and raw materials (e.g. rare earths, PEM membranes, catalysts).
- Enable technology partnerships by supporting co-investment and IP-sharing between Australian innovators and Indian manufacturers.
- Harmonise product and safety standards to support interoperable systems, accelerating project deployment and export-readiness—consistent with recommendations from the Hydrogen RD&D Collaboration Opportunities: India report [104].

By activating these levers, AI-ECTA can become a backbone agreement for a regional green hydrogen manufacturing corridor.

Embed Green Hydrogen into a Strategic Goods Framework under AI-ECTA

To unlock the full trade potential of green hydrogen, AI-ECTA should be expanded to classify green hydrogen and its derivatives—such as green ammonia and green iron—as strategic clean energy goods. Doing so would:

- Enable streamlined regulatory and customs processes for low-emissions exports.
- Support the inclusion of verified product origin and carbon intensity certification, aligning with proposals for a Clean Commodities Trading Platform [105].
- Facilitate bilateral infrastructure coordination, such as port-to-port hydrogen corridors and shared storage or bunkering hubs.

Embedding green hydrogen into a strategic trade category would elevate its treatment under AI-ECTA and position Australia and India to lead in shaping Indo-Pacific clean energy trade norms.

Create an ECTA-Backed Innovation & Financing Window

Australia and India could establish an AI-ECTA-linked clean energy innovation and financing mechanism—anchored through institutions such as the CEFC and India's National Green Hydrogen Mission [106]. This dedicated window could:

- Co-finance pilot deployments, front-end engineering design (FEED) studies, and early-stage infrastructure
- Offer concessional or blended finance instruments aligned with each country's decarbonisation and manufacturing objectives
- Leverage frameworks from the Climate Finance Leadership Initiative India to scale private investment and accelerate commercial readiness [107].

This approach would link trade facilitation with industrial acceleration—turning ECTA into a platform that not only removes barriers but actively catalyses cross-border green hydrogen deployment.

Align on CBAM and Carbon Accounting Readiness

As exports of hydrogen and clean commodities to Europe and Asia grow, AI-ECTA could serve as a vehicle to align carbon accounting standards and lay the groundwork for a regional "CBAM-lite" framework. This would:

- Minimise future trade friction by harmonising emissions measurement and reporting.
- Accelerate the adoption of certification schemes like Guarantees of Origin.
- Position India as a leader in low-carbon export competitiveness, while leveraging Australia's clean resource advantage and regulatory credibility.

Embedding carbon transparency into ECTA provisions would future-proof trade flows and support regional decarbonisation leadership.

Australia–India Critical Minerals Investment Partnership (CMIP)

If strategically leveraged, the CMIP could evolve from a resource-focused agreement into a coordinated industrialisation platform—anchoring bilateral efforts to build secure, low-emissions, and geopolitically aligned green hydrogen supply chains. By linking critical minerals investment to downstream hydrogen manufacturing and co-development initiatives, the CMIP can underpin joint value creation, not just raw material trade.

Using CMIP to Forge Critical Mineral Links in the Hydrogen Economy

Secure Supply of Critical Inputs for Electrolyser Manufacturing

India's push to scale domestic electrolyser manufacturing—targeting 5 GW by 2030—relies on secure access to critical minerals like nickel, cobalt, rare earths, and high-purity alumina. Australia, with its rich resource base, is ideally positioned to supply these inputs [109].

The Critical Minerals Investment Partnership (CMIP) can be leveraged to:

- Facilitate long-term offtake agreements and JV structures between Australian miners and Indian manufacturers.
- Incentivise co-located processing in Australia, linked to value-added manufacturing in India.
- Build ethical, geopolitically aligned supply chains supporting both nations' hydrogen industrialisation goals.

De-risk Australia–India Value Chains for Green Hydrogen Exports

Green hydrogen and its derivatives (e.g. ammonia, green iron) require resilient input supply chains. By integrating CMIP with hydrogen export strategies:

- Australia can offer critical mineral-backed trade security, strengthening India's confidence in long-term offtake arrangements.
- India can prioritise infrastructure and trade facilitation agreements for commodities derived from CMIP-enabled projects (e.g. vanadium batteries, HBI exports) [110].

Launch a Joint Green Hydrogen–Critical Minerals Innovation Platform

The Critical Minerals Investment Partnership (CMIP) could be expanded to support bilateral RD&D focused on reducing mineral intensity and enhancing circularity in hydrogen technologies. Key focus areas include:

- Optimising material use in electrolysis and storage systems (e.g. tailoring PEM vs. alkaline designs to local resource profiles).
- Advancing recovery and recycling techniques to enable circular use of nickel, cobalt, and rare earths.
- Accelerating substitution research to reduce dependency on scarce or geopolitically constrained minerals.

This aligns India's tech-forward mission-led approach with Australia's deep R&D capabilities through agencies like CSIRO and ARENA —laying the groundwork for a resilient and resource-smart hydrogen industry.

Create a Green Hydrogen–Minerals Trade Corridor under AI-ECTA

The Critical Minerals Investment Partnership (CMIP), when aligned with the Australia–India Economic Cooperation and Trade Agreement (AI-ECTA), can underpin a dedicated green hydrogen–minerals trade corridor [111]. This corridor would facilitate:

- Preferential tariff treatment and streamlined customs processes for critical minerals and hydrogen-related goods.
- Joint ESG certification and traceability systems to ensure supply chain integrity for both minerals and hydrogen.
- Strategic co-investment zones or Special Economic Zones (SEZs) connecting Indian manufacturing hubs with Australian mining and processing regions.

This corridor would help embed resilient, low-emissions supply chains into a regional clean energy framework—enabling faster scaling of green hydrogen and its upstream inputs.

The Australia–India Critical Minerals Investment Partnership (CMIP) can serve as a foundational enabler for green hydrogen collaboration by reinforcing upstream supply chains vital to both countries' clean energy transitions. When aligned with frameworks such as the India–Australia Green Hydrogen Taskforce, Australia's National Hydrogen Strategy, and Hydrogen RD&D Collaboration Opportunities: India, CMIP reveals four high-impact pathways to deepen bilateral cooperation:

1. Secure supply of critical minerals for electrolyser and hydrogen infrastructure manufacturing.
2. Launch joint innovation platforms for mineral efficiency, recycling, and substitution.
3. Establish a green hydrogen–minerals trade corridor under AI-ECTA.
4. Co-invest in processing capacity and clean energy SEZs across both nations.

These initiatives could transform CMIP from a bilateral investment tool into a strategic industrial policy lever—positioning Australia and India as co-architects of resilient, ethical, and low-emissions hydrogen value chains.

The Comprehensive Economic Cooperation Agreement (CECA)

The Comprehensive Economic Cooperation Agreement (CECA) — currently under negotiation between Australia and India—represents a critical opportunity to deepen structural support for green hydrogen manufacturing, deployment, and trade integration [112]. Unlike the interim AI-ECTA, CECA aims to be a full-spectrum agreement and can institutionalise long-term frameworks that underpin the green hydrogen economy.

Deploying CECA as a Catalyst for Joint Hydrogen Manufacturing and Trade

Codify Green Hydrogen and Derivatives as Strategic Trade Commodities

CECA could formally designate green hydrogen and its derivatives—including ammonia and green iron—as strategic clean energy goods, unlocking a suite of trade-enabling benefits:

- Preferential tariff treatment and streamlined customs protocols.
- Clear, co-developed rules of origin that recognise collaborative value chains (e.g. Indian-manufactured electrolysers powered by Australian critical minerals).
- Regulatory clarity to support cross-border investment and supply chain integration.

This would reinforce the concept of the Clean Commodities Trading Initiative and embed hydrogen-linked trade within a trusted Indo-Pacific framework —bolstering industrial confidence and regional cooperation.

Embed a Bilateral Certification and Carbon Accounting Framework under CECA

CECA could establish a legally supported mechanism to accelerate cross-border green hydrogen trade by enabling:

- Mutual recognition of Guarantees of Origin (GO) and equivalent certification schemes.
- Alignment on carbon intensity methodologies, easing future compliance with CBAM and other destination market standards.
- Facilitation of joint low-carbon procurement pathways for government and industry across both nations.

Such a framework would strengthen trade credibility, reduce duplication, and position India and Australia as regional leaders in certifiable, low-emissions hydrogen value chains.

Launch a CECA-Backed Green Investment & Innovation Platform

A dedicated CECA investment chapter could serve as a catalyst for joint hydrogen infrastructure by:

- Incentivising cross-border joint ventures in electrolyser manufacturing, hydrogen deployment, and port logistics.
- Unlocking concessional and blended finance through coordinated mechanisms involving CEFC, ARENA, and India's National Green Hydrogen Mission.
- Building on the Critical Minerals Investment Partnership to enable co-located hydrogen and mineral processing hubs across both countries.

This platform would accelerate industrial collaboration, scale technology deployment, and deepen value-chain integration between India and Australia.

Establish a CECA Clean Energy Working Group with a Hydrogen Track

A dedicated hydrogen track within CECA's proposed Clean Energy Working Group could:

- Coordinate research, workforce development, and pilot deployments.
- Align standards for electrolyser efficiency, storage, and safety.
- Monitor and accelerate progress on taskforce recommendations, turning them into binding deliverables.

Advance Bilateral Collaboration on Green Ammonia for Fertiliser

The Governments of India and Australia should prioritise the development of a joint green ammonia initiative focused on fertiliser production. This collaboration could include:

- Co-investment in enabling infrastructure;
- Jointly developed deployment models and IP;
- Offtake strategies aligned with India's agricultural demand and Australia's hydrogen supply capacity.

Such an initiative would support mutual decarbonisation goals and serve as a practical, near-term anchor for bilateral cooperation under the National Green Hydrogen Mission and Australia's Hydrogen Headstart program.

Convene a Bilateral Roundtable on Green Hydrogen and Ammonia

The Indian High Commission to Australia, in collaboration with the Australian High Commission to India and relevant national stakeholders, should convene a bilateral roundtable to advance practical collaboration between industry and government on green hydrogen and ammonia.

- **Format**: A high-level, diplomatic roundtable hosted by the Indian High Commission, with reciprocal involvement from the Australian High Commission.
- **Purpose**: To bring together key public and private sector stakeholders from both countries to explore a potential Australia–India green ammonia joint venture, with a focus on co-investment, shared intellectual property development, and coordinated deployment strategies that support clean trade and industrial decarbonisation.
- **Focus**: The session may focus on joint green fertiliser project development, or take a broader view of commercial opportunities, policy coordination, and the current disconnect between government ambition and industry readiness.
- **Participants**: Senior representatives from government, industry, and technology sectors across both India and Australia.

This roundtable would serve as a focused, action-oriented platform to unlock tangible bilateral project opportunities in the hydrogen economy.

CONCLUSION

The Australia–India green hydrogen partnership is not merely an opportunity—it is a strategic imperative. It represents the fusion of complementary capabilities: Australia's renewable resources, critical minerals, and early-stage project development, with India's scale, cost-competitive manufacturing, and energy demand trajectory. As the world shifts toward decarbonised industrial systems, these national strengths must be woven into a joint hydrogen ecosystem that defines the Indo-Pacific energy architecture for decades to come.

This report has outlined that many of the bilateral mechanisms, policy platforms, and industrial alignments already exist. The challenge now is to activate them—moving from commitment to coordinated execution. However, to realise the full potential of this collaboration, policymakers must adopt a more nuanced view of hydrogen's role: green hydrogen is not an industry, but a technology enabler. It offers a transitional solution for specific applications—particularly where fossil gas cannot be displaced via electrification alone. Effective support must therefore be use-case specific, anchored in commercial realities, and attuned to strategic national goals.

The findings suggest three pivotal strategic shifts are now required:

1) From Commitments to Co-Investment
Existing frameworks—such as CECA, AI-ECTA, CMIP, and AISRF—must evolve from diplomatic signals into operational delivery channels. This means embedding hydrogen supply chain terms into trade agreements, harmonising certification standards, and deploying public finance in ways that reduce risk and crowd-in private capital.

See APPENDIX B: AUS-IND GREEN HYDROGEN FLAGSHIP OPPORTUNITIES

2) From Export Hubs to Shared Value Chains
Strategic collaboration must extend beyond commodity exports toward joint manufacturing, infrastructure, and standards. Hydrogen and its derivatives should be treated as strategic trade goods—with harmonised certification, preferential access, and long-term offtake coordination.

3) From Project Pipelines to Systemic Thinking
Green hydrogen must be embedded within a broader clean energy and industrial strategy—integrating port infrastructure, trade corridors, concessional finance, and carbon transparency. Governments must understand the physics and economics of hydrogen production: smaller projects, while politically attractive, will struggle with commercial viability due to scale requirements. Mechanisms should be structured to allow the market—through its due diligence and investment intelligence—to select bankable projects.

KEY STRATEGIC INSIGHTS

- Global competitiveness must be a non-negotiable filter. Both Australia and India are competing against China, the EU, and the Gulf states. Investment should be channelled toward projects that can be competitive without permanent subsidies. Production incentives, if misapplied, risk inflating shareholder returns rather than achieving emissions reductions.

- Concessional finance must be used intelligently. In sectors where industry stands to gain more than the state (e.g. green iron), concessional loans structured as equity-like instruments offer strong taxpayer ROI. They catalyse short-term decarbonisation while avoiding long-term fiscal exposure.

- India and Australia are natural strategic partners for green ammonia production. India's energy insecurity, high fertiliser demand, and food security imperatives suggest that its long-term green ammonia production costs will likely undercut Australia's.

However, Australia brings distinct early-mover advantages: world-class research institutions, a strong innovation ecosystem, and a AAA credit rating that provides reliable access to low-cost global capital [113]. These strengths position Australia as an ideal partner in developing the green ammonia value chain—particularly through joint ventures, co-manufacturing platforms, and shared innovation. Prioritising collaboration now will secure offtake pathways, anchor bilateral supply chains, and ensure Australia maintains strategic relevance in the global ammonia trade.

- In contrast, green iron is where Australia can lead the world. Australia holds the world's largest known iron ore reserves—approximately 52 billion tonnes, accounting for 28% of global supply—and is the largest global exporter, responsible for over 53% of the world's iron ore trade as of 2023 [114]. More importantly, Australia's advantage lies not just in the scale of reserves, but in its unmatched operational efficiency, established export infrastructure, and advanced ore extraction capabilities. These factors give Australia a cost and reliability edge in supplying feedstock for green steel and iron production. However, this competitiveness primarily benefits the private sector. Public support should therefore be time-bound and strategic—focused on concessional finance mechanisms that unlock first-mover investment while avoiding long-term subsidy dependency or inflated shareholder returns once market viability is proven.

- The cost of energy is foundational—both to hydrogen economics and national industrial competitiveness.

- Green hydrogen is, at its core, a conversion of electricity into a transportable chemical energy carrier. This means that the cost of electricity is the single largest determinant of hydrogen production cost—typically accounting for 60–80% of levelised hydrogen prices. If electricity is expensive, green hydrogen is unviable [115]. If it is cheap, hydrogen becomes an enabler of broader decarbonisation and export strategies.

- Australia and India must therefore treat renewable energy not just as a climate policy, but as a sovereign industrial asset. Unlike fossil fuels, renewable energy has deflationary properties over time—once built, the marginal cost of generation approaches zero. This makes renewables the only viable path to structurally lower energy prices in the long run.

- For Australia, the opportunity lies in converting its vast wind and solar resources into globally competitive energy products—green ammonia, green iron, and other clean commodities. For India, scaling domestic renewable capacity is essential to stabilising energy imports, lowering fertiliser costs, and powering industrial growth.

- However, to realise these benefits, policy must shift from volume to value. It is not enough to deploy renewable energy at scale; it must be delivered at a price and reliability that gives industry a competitive edge. That requires long-term grid planning, market reform, investment in storage and transmission, and integrated hydrogen infrastructure that reduces duplication and risk.

- Ultimately, the nations that win the clean energy race will not be those with the most announcements, but those with the lowest cost base for industrial production. Strategic hydrogen policy must therefore be judged not by the number of projects announced, but by the price of energy they can access, the cost per kilogram of delivered hydrogen, and the competitiveness of their downstream exports in global markets.

Strategic Follow-On Research Opportunities

1) Joint Research into Industrial Decarbonisation Pathways Beyond Hydrogen

A deep-dive into technologies that can displace fossil gas in heat-intensive industries—including thermal energy storage, solar thermal, and hybrid systems—will help both nations determine where hydrogen offers the most value.

2) Developer Sentiment and Market Readiness Study (India–Australia Comparative Report)

A structured study across both markets will capture project bottlenecks, benchmark policy mechanisms (e.g. CfDs, certification, concessional loans), and prioritise interventions based on real-world bankability.

3) Policy Impact Modelling: AREH, WGEH, and the Future of Green Hydrogen Megaprojects

Scenario-based modelling with InterContinental Energy would illustrate how different policy levers affect project timelines, scale, and trade outcomes—helping design replicable models for future bilateral infrastructure projects.

Australia and India have a generational opportunity to collaborate not only as producers and consumers- but as co-designers of the trade, policy, and financing systems that will define global clean energy markets

FINAL WORD

Hydrogen must not be reduced to hype or hollow nationalism. It is a high-capital, high-risk, high-reward technology with a narrow but vital role in decarbonisation. **Australia and India have a generational opportunity to collaborate not only as producers and consumers—but as co-designers of the trade, policy, and financing systems that will define global clean energy markets.** To do so requires focus, coordination, and the discipline to back what works—and walk away from what doesn't.

APPENDIX A

KEY BUSINESSES & PROJECTS INCLUDE:

Australia

Fortescue: Fortescue is developing multiple projects, including a Green Iron Project at Christmas Creek in the Pilbara.

Western Green Energy Hub (WGEH) in WA, targeting 50 GW of renewable energy to produce green hydrogen.

Yara Pilbara and ENGIE: Operating the Yuri Project in Western Australia to produce green hydrogen and convert it into green ammonia for fertiliser.

Neoen: Working on projects integrating solar and wind to produce green ammonia in SA.

Fortescue Metals Group: Investing in hydrogen-based green iron production at its operations in WA, aiming for zero-emission steel production.

Rio Tinto: Partnered with Japanese firms to trial hydrogen-based DRI (direct reduced iron) at its iron ore sites.

Sunrise CSP: Specialises in solar thermal energy with potential applications in hydrogen production, featuring Australian design and Indian manufacturing.

Origin Energy & Orica: Partnering on a green ammonia project in the Hunter Valley, NSW. The proposed facility will use renewable hydrogen to decarbonise industrial ammonia production.

Bluescope: Joined forces with BHP and Rio Tinto to explore the development of an Electric Smelting Furnace (ESF) pilot plant in WA known as Project IronFlame.

I**nterContinental Energy:** Spearheading Western Green Energy Hub and Australian Renewable Energy Hub.

Quinbrook Infrastructure Partners: Quinbrook has been collaborating with Central Queensland Metals to develop the Eulogie magnetite iron ore deposit, estimated to contain 465 million tonnes of ore. The project was part of the CQ-H_2 and has stalled.

I**ron Road Ltd:** Working with Revera Energy on the Cape Hardy Green Hydrogen Project in South Australia to develop green ammonia for export; progressing to viable domestic opportunities for green hydrogen, including green iron, peak generation or diesel displacement.

India

Reliance Industries: Investing $75 billion in green energy, including a major green hydrogen project in Gujarat.

NTPC Ltd.: Piloting green hydrogen mobility and blending projects in Ladakh and other states.

ACME Group: Building India's first integrated green hydrogen and ammonia plant in Bikaner, Rajasthan.

I**IT Madras Research Park:** Developing small-scale decentralised green ammonia production technologies.

Tata Steel: Partnering on hydrogen-based steel production trials at its Jamshedpur facility.

JSW Steel: Exploring hydrogen-based steelmaking with plans for pilot plants in Karnataka.

IOCL is developing multiple green hydrogen and ammonia projects as part of its decarbonisation strategy.

Greenko: Backed by GIC and ORIX. Large-scale green hydrogen and ammonia export facility in Kakinada, Andhra Pradesh

Avaada: Large-scale green hydrogen and ammonia export facility in Rajasthan

Larsen & Toubro (L&T): L&T has commissioned its first indigenously manufactured hydrogen electrolyser at the A M Naik Heavy Engineering Complex in Hazira. L&T has dispatched indigenously manufactured high-pressure alkaline electrolysers to Deendayal Port Authority (DPA) in Kandla for a 1 MW green hydrogen plant.

Panipat Green Hydrogen Pvt Ltd L&T Energy Green Tech has secured a significant tender to construct a green hydrogen production facility for Indian Oil Corporation Ltd (IOCL) at its Panipat refinery:

ReNew: L&T has formed a joint venture with Indian Oil Corporation and ReNew to invest up to $4 billion in green hydrogen projects over the next three to five years.

APPENDIX B

Australia–India Green Fertiliser Partnership

Overview

This initiative proposes the establishment of twin green ammonia production facilities—one in Australia and one in India—through a bilaterally coordinated, industry-led and government-backed investment of AUD $1 billion in each country. The goal is to decarbonize fertiliser supply chains, boost domestic manufacturing, and strengthen bilateral clean energy ties.

Structure

- Public Investment Tools: Each government could support the project through:
  - Tax production credits (similar to IRA-style incentives).
  - Targeted support under Australia's Hydrogen Headstart, CEFC finance, or India's PLI scheme.
  - Long-term offtake arrangements with public-sector fertiliser buyers (e.g., IFFCO in India, Orica in Australia).

Private Sector Collaboration

- The initiative encourages collaboration between existing green ammonia developers such as:
  - Orica and Origin Energy (Hunter Valley, Australia)
  - Avaada and ACME Group (Rajasthan, India)
- Electrolyser manufacturers (L&T in India, Hysata or Fortescue in Australia) and renewable energy companies could be brought in to build integrated, localised supply chains in both nations.

Outcomes

- Two commercial-scale green ammonia plants (each ~250,000–500,000 tonnes/year).
- Shared tech and cost-reduction learnings.
- Strengthened bilateral fertiliser security and exports.
- Anchored long-term hydrogen trade cooperation.

Strategic Value

This project positions Australia and India as clean energy partners in decarbonizing agriculture, fostering supply chain integration, and building future hydrogen trade infrastructure.

AUS-IND GREEN HYDROGEN FLAGSHIP OPPORTUNITIES

Australia–India Green Iron–Green Steel Partnership

Overview

This project establishes a cross-border green iron supply chain, where Australian iron ore is processed into green iron using renewable hydrogen and shipped to India for conversion into green steel. The green steel would serve export-oriented sectors, particularly automotive manufacturers in Europe and Asia seeking zero-carbon electric vehicle components.

Structure

- Stage 1 (Australia): Green iron production hubs in Western Australia or South Australia using DRI/HBI technologies powered by renewables.
  - Leverage existing projects by Fortescue or Green Iron SA.
  - Supported by Production tax credits or Hydrogen Headstart mechanisms.
- Stage 2 (India): Green steel conversion facilities at Tata Steel or JSW Steel plants equipped for low-carbon processing.
  - Support via India's PLI scheme or concessional green finance.

Collaboration Opportunities

- Joint ventures between:
  - Iron ore miners and green hydrogen developers in Australia (e.g., FMG, Rio Tinto,, InterContinental).
  - Indian steel majors (e.g., Tata, JSW) and technology providers for low-emission furnaces.
- Logistics and port infrastructure partnerships to streamline green iron exports from SA/WA to Indian steel clusters.

Outcomes

- Creation of a zero-carbon steel value chain between Australia and India.
- Competitive advantage in supplying green steel for global electric vehicle and appliance markets.
- Bilateral R&D on hydrogen-based metallurgy and materials certification.

Strategic Value

This project cements Australia's role as a green resource supplier and India's position as a value-added green manufacturing hub—linking both to premium global markets through climate-aligned supply chains.

REFERENCES

Page 3 ---

[1] Department of Industry, Innovation and Science (Cth), *Australia's National Hydrogen Strategy* (2019) 19 [hyperlink]

[2] ibid

[3] Avendus Capital, *India's Green Hydrogen Quest: A $125-Billion Opportunity by 2030,* pv magazine India (4 April 2024) [hyperlink]

Page 4 ---

[5] Department of Foreign Affairs and Trade (Cth), *Australia–India Economic Cooperation and Trade Agreement (AI-ECTA)*, signed 2 April 2022, [2022] ATNIF 9.

[6] Department of Foreign Affairs and Trade (Cth), *Comprehensive Economic Cooperation Agreement Negotiations,* Department of Foreign Affairs and Trade (Cth), Australia–India Economic Cooperation and Trade Agreement (AI-ECTA), signed 2 April 2022, [2022] ATNIF 9..

[7] Ministry of New and Renewable Energy (India), *National Green Hydrogen Mission: Strategy Document* (Report, January 2023).

[8] Australian Government, Department of Climate Change, Energy, the Environment and Water, *Hydrogen Headstart: Consultation Paper* (November 2023).

[9] Clean Energy Finance Corporation, *Annual Report 2022–23* (Report, October 2023); Australian Renewable Energy Agency, *2022–23 Annual Report* (Report, November 2023).

[10] QUAD Leaders' Meeting, *Clean Energy Supply Chain Principles* (Joint Statement, 23 May 2022); Indo-Pacific Economic Framework for Prosperity, *Clean Economy Pillar: Ministerial Statement* (November 2023).

Page 5 ---

[11] International Energy Agency, *Global Hydrogen Review 2023* (Report, 2023); International Institute for Sustainable Development, *Fossil Fuel Subsidy Tracker* (Database, 2023) https://www.iisd.org; Garnaut, Ross, *The Superpower Transformation* (Black Inc, 2022)

[12] International Partnership for Hydrogen and Fuel Cells in the Economy, *IPHE Hydrogen Production Analysis* (Report, 2022) https://www.iphe.net; IPHE, *Developing a Global Hydrogen Market: IPHE Regulatory Frameworks Report* (Report, 2023)

[13] International Renewable Energy Agency (IRENA), *Geopolitics of the Energy Transformation: The Hydrogen Factor* (Report, 2022); COAG Energy Council, *Australia's National Hydrogen Strategy* (Report, 2019).

[14] Hydrogen Council, *Hydrogen Insights 2023: Global Policy and Project Update* (Report, September 2023); see also BloombergNEF, *Global Hydrogen Strategy Update 2024* (Report, Bloomberg Finance LP, 2024), cited in Climate Finance Leadership Initiative India, *Financing Green Hydrogen in India: Private Sector Considerations to Strengthen India's Enabling Environment for a Competitive Green Hydrogen Economy* (Report, Council on Energy, Environment and Water, 2024).

[15] Meticulous Research, *Green Hydrogen Market by Generation Type* (PEM Electrolyzer, Alkaline Electrolyzer), Energy Source (Solar, Wind), Application (Methanol, Ammonia, Transport, Power, Industry)—*Global Forecast to 2029* (Market Research Report, 2023)

[16] Department of Foreign Affairs and Trade (Cth), *Australia–India Green Hydrogen Taskforce Report* (Report, March 2024); NITI Aayog and Rocky Mountain Institute, *India's Green Hydrogen Policy Roadmap* (Report, 2022); and see Australian Trade and Investment Commission (Austrade), *Opportunities in India's Green Hydrogen Ecosystem* (Report, 2023).

Page 6 ---

[17] Note: In this report, Contracts-for-Difference (CfDs) refer to two primary models—(1) UK-style strike-price mechanisms that guarantee a fixed return over the reference market price; and (2) Indian-style offtake support mechanisms that bridge the gap between market price and developer cost estimates. Distinguishing between these is critical for policy alignment.

Page 7 ---

[i] Ministry of New and Renewable Energy (India), *National Green Hydrogen Mission* (Policy Document, January 2023)

[ii] Department of Industry, Science and Resources (Australia), *Critical Minerals Strategy 2023–2030* (Report, 2023) https://www.industry.gov.au/publications/critical-minerals-strategy-2023-2030.

[iii] International Renewable Energy Agency (IRENA), *Green Hydrogen: A Guide to Policy Making* (Report, November 2020) ibid.

Page 7 ---

[18] International Energy Agency (IEA), *Global Hydrogen Review 2023* (Report, 2023) 22–23 https://www.iea.org/reports/global-hydrogen-review-2023

[19] Clean Energy Council, *Unlocking Australia's Hydrogen Opportunity* (Report, June 2022) 14–15 https://cleanenergycouncil.org.au/

[20] International Renewable Energy Agency (IRENA), *Green Hydrogen Cost Reduction: Scaling up Electrolysers to Meet the 1.5°C Climate Goa*l (Report, December 2020) https://www.irena.org/publications/2020/Dec/Green-hydrogen-cost-reduction.

[21] IPHE, *Hydrogen Certification 2022: IPHE Working Paper* (Report, 2022) https://www.iphe.net/hydrogen-certification.

[22] CSIRO, *Opportunities for Hydrogen in Australia* (Report, 2018) 28–30 https://www.csiro.au/en/news/All/Articles/2018/Opportunities-for-hydrogen-in-Australia.

[23] BloombergNEF, *Hydrogen Market Outlook 2023* (Report, June 2023) https://about.bnef.com/

[24] Australian Government, *Australia–India Economic Cooperation and Trade Agreement (AI-ECTA)* [hyperlink]

[25] International Energy Agency (IEA), *Net Zero by 2050: A Roadmap for the Global Energy Sector* (Report, 2021) 157–162 [hyperlink]

[26] IRENA, *Global Hydrogen Trade to Meet the 1.5°C Climate Goal* (Report Volume II: Trade Outlook, September 2022) https://www.irena.org/publications.

Page 8 ---

[27] Clean Energy Finance Corporation (CEFC), *Hydrogen Market Study (2021);* Commonwealth of Australia, *Hydrogen Headstart Consultation Paper (2023).*

[28] NITI Aayog and RMI, *India's Green Hydrogen Economy: Pathways to Net-Zero (2022)*; IEA, Global Hydrogen Review (2023).

[29] Standard & Poor's, *Sovereign Credit Ratings: 2024 Country List,* https://www.spglobal.com.

[30] Australian Government, *Hydrogen Headstart Consultation Paper* (2023).

[31] Ministry of New and Renewable Energy (India), *National Green Hydrogen Mission Guidelines* (2023); World Bank, *Scaling Hydrogen Finance in India* (2023).

[32] Australian Energy Market Operator (AEMO), *Integrated System Plan* (2022).

[33] NITI Aayog, *Green Hydrogen in India: Roadmap and Opportunities* (2022).

[34] WA EPA, *EPA Report 1722: ENGIE Yuri Project Assessment* (2024); GHD, *Water for Hydrogen in WA* (2023).

[35] IREDA, *Feasibility Studies for Hydrogen Hubs in India* (2023).

[36] CEFC, *Australian Hydrogen Investment Report* (2023).

[37] Ministry of Power (India), *PLI Scheme for Electrolyser Manufacturing* (2023).

[38] Infrastructure Australia, *Energy Infrastructure Audit* (2021); AEMO, *NEM Infrastructure Insights* (2022).

[39] MNRE India, *Green Hydrogen Corridors and Port Investment Plans* (2023).

[40] Austrade, *Australia's Clean Energy Export Potential* (2023).

[41] FICCI, *India's Hydrogen Derivatives Export Opportunity* (2023).

[42] Austrade, *Australia's Clean Energy Export Potential* (2023).

Page 10 ---

Department of Climate Change, Energy, the Environment and Water (Cth), ***Hydrogen Headstart Program*** (Factsheet, Australian Government, 2023) *Austrade*, Australia's Clean Energy Export Potential (2023).

Department of the Prime Minister and Cabinet (Cth), ***Future Made in Australia*** (Australian Government, 2024) https://www.pmc.gov.au/news-centre/economy/future-made-australia-policy-package.

COAG Energy Council, ***Australia's National Hydrogen Strategy*** (Commonwealth of Australia, 2019) [hyperlink]

Australian Government, ***Australia–India Critical Minerals Investment Partnership*** (Web Page, 14 March 2023) [hyperlink]

Clean Energy Finance Corporation, *About the CEFC* (Web Page, 2024) [hyperlink]

Australian Renewable Energy Agency, ***Renewable Hydrogen Deployment Funding Round*** (Web Page, 2021) [hyperlink]

Page 11 ---

Australian Renewable Energy Agency, ***Hydrogen R&D and Commercialisation Support*** (Web Page) [hyperlink]

Northern Australia Infrastructure Facility, *About NAIF* (Web Page, Australian Government) [hyperlink]

Government of Western Australia, ***Western Australian Renewable Hydrogen Strategy*** (Report, 2019) [hyperlink]

Queensland Government, ***Queensland Hydrogen Industry Strategy 2019–2024 (Report***, Department of State Development, Manufacturing, Infrastructure and Planning, May 2019) [hyperlink]

Government of South Australia, ***South Australia's Hydrogen Action Plan*** (Report, November 2019) [hyperlink]

Australian Government, ***National Reconstruction Fund*** *Corporation Act 2023 (Cth)* [hyperlink]

Department of Education (Cth), ***Australia–India Strategic Research Fund*** (Web Page, 2024) https://www.education.gov.au/australia-india-strategic-research-fund.
Page 12 ---

Ministry of New and Renewable Energy (India), ***National Green Hydrogen Mission*** (Press Release, 4 January 2023) https://pib.gov.in/PressReleasePage.aspx?PRID=1888329.

Ministry of New and Renewable Energy (India), ***Scheme Guidelines for SIGHT Programme*** (Web Page, 2023) [hyperlink]

Ministry of Heavy Industries (India), ***Production Linked Incentive Scheme*** *for National Programme on Advanced Chemistry Cell (ACC) Battery Storage* (Notification, 9 June 2021) [hyperlink]; see also Ministry of New and Renewable Energy (India), ***PLI Scheme for Manufacturing of Electrolysers under the National Green Hydrogen Mission*** (Press Note, 2023) [link]

Australian Government Department of Education, ***Australia–India Strategic Research Fund*** (Web Page, 2024) [link]

Ministry of Heavy Industries (India), *Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India* (FAME India) **Scheme Phase II** (Web Page, 2023) https://heavyindustries.gov.in/UserView/index?mid=2464.

Indian Oil Corporation, *Green Hydrogen Initiatives* (Web Page, 2024) [hyperlink]; see also NTPC Limited, *Green Hydrogen Projects* (Web Page, 2024) [hyperlink]

Gujarat Government, ***Gujarat Green Hydrogen Policy 2023*** (Policy Document, 2023) [hyperlink]; see also Rajasthan Government, ***Rajasthan Investment Promotion Scheme*** (RIPS 2022) (Policy Document, 2022) [hyperlink]

Ministry of External Affairs (India), *India–Australia Green Hydrogen Joint Statement* (Media Release, 2023) [hyperlink]; Ministry of New and Renewable Energy (India), *Bilateral Cooperation with Germany, UAE, and Japan on Hydrogen* (Web Page, 2023) [hyperlink]

Page 16 ---

[43] Federal Ministry for Economic Affairs and Climate Action (Germany), *National Hydrogen Strategy* (Report, June 2020) [hyperlink]; see also International Energy Agency, *Global Hydrogen Review 2023* (Report, 2023) 32–35 https://www.iea.org/reports/global-hydrogen-review-2023.

[44] Department of Industry, Science and Resources (Cth), *Australia–India Critical Minerals Investment Partnership* (Webpage, 23 March 2023) [hyperlink]

[45] Department of Education (Cth), *Australia–India Strategic Research Fund* (Webpage, Australian Government, 27 March 2024) [link]

[46] Department of Foreign Affairs and Trade (Cth), *India Country Brief* (Webpage, Australian Government, 26 March 2024) https://www.dfat.gov.au/geo/india/india-country-brief.

Page 18 ---

[47] Department for Business, *Energy and Industrial Strategy (UK), Contracts for Difference Allocation Round 4: Final Results*, (Report, 2022) [hyperlink]

[48] Australian Government, Department of Climate Change, Energy, the Environment and Water, *Hydrogen Headstart,* (Web Page, 2023) [hyperlink]

[49] Government of India, Ministry of New and Renewable Energy, *National Green Hydrogen Mission,* (Mission Document, 2023) [link]

[50] International Energy Agency, *India's Green Hydrogen Policy,* (Analysis Brief, 2023) [link]

Page 19 ---

[51] United States, *Inflation Reduction Act of 2022*, 42 USC § 18701 (2022).

[52] Australia, *Future Made in Australia Act – Consultation Paper* (Department of the Prime Minister and Cabinet, April 2024) 4–6.

[53] Based on primary stakeholder consultation conducted during the 2024–2025 India–Australia Green Hydrogen Collaboration Roundtable and interviews.

[54] Government of India, *National Green Hydrogen Mission: Mission Document* (Ministry of New and Renewable Energy, January 2023) 12–15

[55] European Commission, *Regulation (EU) 2023/956 Establishing a Carbon Border Adjustment Mechanism* [2023] OJ L130/52.

Page 20 ---

[56] Elizabeth Thurbon and Oliver Yates (2025) *The Case for an Australian Clean Commodities Trading Initiative [Studies in Statecraft]* (Canberra: Asia-Pacific Development, Diplomacy & Defence Dialogue) [hyperlink]

[57] Ministry of New and Renewable Energy (India), *Hydrogen Schemes & Guidelines* (Web Page, updated 16 March 2024) [link]

Page 21 ---

[58] ENGIE Australia and Pacific, *Project Yuri Overview* (Web Page, 2023) [hyperlink]

[59] Environmental Protection Authority (WA), *EPA Report 1722: Ammonia Plant Murujuga (Burrup Peninsula) Renewable Hydrogen Project – Assessment Report* (August 2022)

[60] Australian Renewable Energy Agency (ARENA), *ENGIE's Project Yuri to Produce Renewable Hydrogen in the Pilbara* (Media Release, 28 September 2022) [hyperlink]; Clean Energy Finance Corporation, *CEFC Finance Supports WA's First Renewable Hydrogen Project at Commercial Scale* (Media Release, 28 September 2022) [link]

Page 22 ---

[61] Australian Bureau of Agricultural and Resource Economics and Sciences, *Agricultural Commodities: December Quarter 2024* (Report, December 2024) 45.

[62] Australian Bureau of Agricultural and Resource Economics and Sciences, *Snapshot of Australian Agriculture 2024* (Factsheet, February 2024).

[63] Department of Agriculture, Fisheries and Forestry, *Agriculture and the Australian Economy: Sector Analysis 2024* (Report, 2024) 8.

[64] Australian Bureau of Agricultural and Resource Economics and Sciences, *Farm Performance: March Quarter 2024* (Report, March 2024) 12.

Page 23 ---

[65] Example only

[66] Example only

[67] Example only

Page 24 ---

[68] Clean Energy Finance Corporation, *Annual Report 2022–23* (Report, 2023) 16–19; see also KfW Development Bank, *KfW Position Paper: Concessional Finance and Blended Instruments* (Report, January 2022) [link]

[69] Clean Energy Finance Corporation, *Annual Report 2022–23* (Report, 2023) 6, 16–17. The CEFC invests in hydrogen through its

dedicated AUD$300 million Advancing Hydrogen Fund, as well as in hydrogen-related climate technology opportunities. Equity and debt finance are used to support projects that align with the National Hydrogen Strategy. CEFC financing for hydrogen projects has totaled more than AUD$40 million. This includes the CEFC investment of AUD$15 million in Hysata's most recent Series B financing round; see Clean Energy Finance Corporation, *Advancing Hydrogen Fund* (Web Page, 2024)

[70] BloombergNEF and S&P Global, *Financing the Transition to Net Zero: Unlocking Blended Finance* (Report, 2022) [hyperlink]

[71] Ministry of New and Renewable Energy (IN), *National Green Hydrogen Mission: Strategic Interventions for Green Hydrogen Transition (SIGHT) Programme Guidelines – Component I* (Guidelines, 2023) 3–4.

[72] NITI Aayog (IN), *Harnessing Green Hydrogen: Opportunities for Deep Decarbonisation in India* (Report, June 2022) 41–44.

Page 25 ---

[73] This report outlines CEFC's role in early-stage project development, including co-funding FEED and feasibility studies, particularly in hydrogen and emerging clean industries; Clean Energy Finance Corporation (AU), *Annual Report 2022–23* (Report, 2023) 56–57.

[74] This factsheet illustrates the EU's "gold standard" approach, including matched funding for FEED studies and early-stage development as part of its Innovation Fund design; see European Commission, *Innovation Fund: Overview of the First and Second Calls for Large-Scale Projects* (Factsheet, 2022).

[75] This report outlines ARENA's ongoing support for early-stage feasibility and Front-End Engineering Design (FEED) studies in the hydrogen and renewable sectors, including reference to co-funding models; see Australian Renewable Energy Agency (AU), *Annual Report 2022–23* (Report, 2023) 46–49.

[76] This guideline outlines the operational framework for NGHM's pilot and R&D components, including reference to cost-sharing mechanisms, which are typically determined through proposal-based selection without uniform percentage allocations—supporting the claim of ad hoc arrangements; see Ministry of New and Renewable Energy (IN), *National Green Hydrogen Mission: Guidelines for Pilot Projects, R&D, and Related Schemes* (Government Guideline, 2023)

[77] Australian Renewable Energy Agency, Feasibility and Design Funding Program Guidelines (Guidelines, 2021) [hyperlink]; Ministry of New and Renewable Energy (IN), *National Green Hydrogen Mission: R&D and Pilot Project Guidelines* (Government Guideline, 2023) https://mnre.gov.in.

Page 26 ---

[78] Climate Energy Finance, *A Price on Carbon: Building Towards an Asian CBAM* (Report, 2025) https://climateenergyfinance.org.

[79] Centre for Economic Futures, *A Price on Carbon: Building Towards an Asian CBAM* (Report, 5 June 2025).

[80] COAG Energy Council, *Australia's National Hydrogen Strategy* (Report, November 2019); Department of Foreign Affairs and Trade, *Australia–India Economic Cooperation and Trade Agreement* (Treaty, Signed 2 April 2022) [hyperlink]

[81] Climate Energy Finance, *A Price on Carbon: Building Towards an Asian CBAM* (Report, 2025) https://climateenergyfinance.org.

[82] Australian Government, *Future Made in Australia Act: Consultation Paper* (Report, April 2024) https://www.pmc.gov.au.

[83] Bureau of Energy Efficiency (India), *Carbon Credit Trading Scheme, 2023* (Notification No 2728(E), 28 June 2023) [hyperlink]

[84] International Energy Agency, *Carbon Border Adjustment Mechanisms: Design, Implementation, and WTO Compatibility* (Report, June 2022) 5–8 [hyperlink]

[85] Australian Bureau of Agricultural and Resource Economics and Sciences, *Farm Performance: March Quarter 2024* (Report, March 2024) 12; for analysis on Indian and Chinese carbon market development see International Energy Agency, *India Energy Outlook 2021* (Report, February 2021) 102–105 [hyperlink]; International Carbon Action Partnership, *China National ETS* (Factsheet, November 2023) [hyperlink].

[86] Climate Energy Finance, *A Price on Carbon: Building Towards an Asian CBAM* (Report, 2025) [hyperlink]

[88] Department of Climate Change, Energy, the Environment and Water (Cth), *National Hydrogen Strategy: A Stronger Australia through Hydrogen* (Report, 2024) 16–17 [link]

[89] Australian Hydrogen Council, *Unlocking Australia's Hydrogen Opportunity* (Policy Paper, March 2024) 9–10 [link]; Climate Energy Finance, *Powering Western Australia's Future* (Report, June 2025) 15 [link]; see also nternational Energy Agency, Global Hydrogen Review 2023 (Report, 2023) 58 [hyperlink]

[90] Ministry of New and Renewable Energy (India), *National Green Hydrogen Mission: Mission Document* (Policy Document, January 2023) [hyperlink]

Page 28 ---

[91] Geoscience Australia, *Australia's Identified Mineral Resources 2023* (Report, 2023) 25.

[92] CSIRO, *Green Steel Opportunities for Australia* (Report, June 2023) 6–9; see also Australian Industry Energy Transitions Initiative, *Iron and Steel 2050: Decarbonisation Pathways* (Report, 2022) 22–24.

Page 29 ---

[93] Clean Energy Finance Corporation, *Hydrogen Market Study: Sector Analysis Summary* (Report, February 2021) 16–18.

[94] CSIRO, *Opportunities for Australia from Hydrogen Exports* (Report, 2018) 30–32; see also International Renewable Energy Agency, *Innovation Outlook: Renewable Ammonia* (Report, 2022) 14–21

[95] IEA's Global Hydrogen Review 2023 provides international benchmarks and competitiveness analysis relevant to Australia's and India's positioning in green ammonia see International Energy Agency, *Global Hydrogen Review 2023* (Report, September 2023) 52–56.

Page 30 ---

[96] AI-ECTA (n 5); Department of Foreign Affairs and Trade (Cth), *Comprehensive Economic Cooperation Agreement Negotiations with India* (Web Page, 2024) [hyperlink]; Australian Government, *Joint Statement on the Australia–India Critical Minerals Investment Partnership* (Media Release, 12 March 2023) [hyperlink]

Australian Government Department of Education, *Australia–India Strategic Research Fund* (Web Page, 2024) [link]

[97] The White House, *Fact Sheet: Quad Leaders' Summit* (Fact Sheet, 24 May 2022) [hyperlink]

[98] (n 96)

Page 31 ---

[99] Department of Foreign Affairs and Trade (Cth), *An India Economic Strategy to 2035: Navigating from Potential to Delivery* (Report, March 2022) [hyperlink]

[100] (n 10)

Page 32 ---

[101] Ministry of New and Renewable Energy (India) and Department of Industry, Energy and Emissions Reduction (Australia), *Letter of Intent on New and Renewable Energy Technology* (15 February 2022)

Page 33 ---

[102] Department of Climate Change, Energy, the Environment and Water (Cth) and Ministry of New and Renewable Energy (India), *India–Australia Green Hydrogen Taskforce: Terms of Reference* (24 May 2023) [hyperlink]

Page 34 ---

[103] (n 24)

Page 35 ---

[104] Mission Innovation, *Hydrogen RD&D Collaboration Opportunities: India* (Report, September 2022) (n 24)

[105] (n 56)

[106] Government of India, *National Green Hydrogen Mission: Mission Document* (Report, Ministry of New and Renewable Energy, 4 January 2023)

[107] Climate Finance Leadership Initiative India, *Mobilising Capital for a Sustainable Future: Building India's Green Finance Ecosystem* (Report, July 2023) [hyperlink]

Page 36 ---

[108] Aarushi Koundal, *'Requirement of Key Minerals Bottleneck for Scaling Up India's Green Hydrogen Electrolyser Manufacturing'* (Online Article, 23 October 2023) ET EnergyWorld

[109] Aarushi Koundal, *'Requirement of Key Minerals Bottleneck for Scaling Up India's Green Hydrogen Electrolyser Manufacturing'* (Online Article, 23 October 2023) ET EnergyWorld [hyperlink]

[110] Ministry of Mines (India), *Critical Minerals for India* (Report, June 2023) [hyperlink]

Page 37 ---

[111] Department of Industry, Science and Resources (Cth), *Milestone in India and Australia Critical Minerals Investment Partnership* (Media Release, 10 March 2023) [link]; Department of Foreign Affairs and Trade (Cth), *Australia–India Economic Cooperation and Trade Agreement* (29 December 2022) [link];

[112] Department of Foreign Affairs and Trade (Cth), *Australia–India Comprehensive Economic Cooperation Agreement* (CECA) (Negotiation Overview, 2025) [hyperlink]

Page 40 ---

[113] Department of Industry, Science and Resources (Cth), *Australia's National Hydrogen Strategy* (Report, 2019) [hyperlink]

[114] Department of Jobs, Tourism, Science and Innovation (WA), *Western Australia Iron Ore Profile – May 2024* (Report, May 2024) [link]

[115] (n 113)

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- Mr. P.C. Garg, National Solar Energy Federation of India
- Gopi Kumar, SembCorp
- Kuhoo Saxena, ReNew
- Mudit Parashar, ReNew
- Navdeep Gupta, SembCorp
- Siddharth Raicharya, Veena Energy
- Vijay Mohan, Axis Energy
- Vinay Vyas, Enrich Energy
- John Grimes, Smart Energy Council
- Scott Hamilton, Smart Energy Council

Australian Forum Participants

Participants attended The Future of Net Zero in Asia forum held at the University of Western Australia on Tuesday, May 6, 2025 from 5:30 PM to 8:30 PM (AWST)

- Professor Peta Ashworth AO, Curtin Institute for Energy Transition
- Oliver Yates, GAW Capital
- Tim Buckley, Climate Energy Finance (CEF)
- Isaac Hinton, InterContinental Energy
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