11 April 2025

CHAMBER OF MINERALS AND ENERGY WA

Strategic Engagement of Research and Development Secretariat
Governance and Engagement, Science Division
Department of Industry, Science and Resources
2 Phillip Law Street
Canberra ACT 2601

Sent via email: RDReview@industry.gov.au

Strategic Examination of R&D Discussion Paper

Dear Secretariat,

The Chamber of Minerals and Energy of Western Australia (CME) is the peak representative body for the resources sector in WA. CME is funded by member companies responsible for 24 per cent of company taxes paid in 2023-24[1] and supports the Paris Agreement and its goal of limiting global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, by reducing emissions to net zero as soon as possible and no later than 2050.[2]

Exports from the WA resources sector are critical to the world's net zero transition and society's modern technologies,[3] helping to advance our plan for a Future Made in Australia (FMA). In 2023-24, the WA resources sector accounted for 56 per cent of resources exports and 52 per cent of resources capital expenditure in Australia.[4] It is also one of the highest productivity sectors.[5]

Expenditure on research and development (R&D) and technological innovation is essential to improving the WA resources sector's productivity, maintaining its international competitiveness and achieving Australia's 2050 net-zero target.

In 2021-22, business expenditure on R&D by the WA resources sector totalled $566 million, accounting for 63.9 per cent of national mining R&D and 33.1 per cent of total WA R&D.[6] Some of the sector's key priorities for R&D include:[7]

- Lowering the cost of low-emission, reliable energy solutions such as power generation, transmission and storage, electrification and other efficiency measures.
- Developing and commercialising low carbon industrial production processes for key materials such as ammonia, alumina and iron.[8]
- Developing processes and adopting technologies to improve the efficiency and safety of exploration, extraction, processing, maintenance and the associated control systems across various operations.

[1] Excludes fringe benefits tax, petroleum resource rent tax and fuel excise duty. Commonwealth of Australia, Final Budget Outcome 2023-24, The Treasury, 30 September 2024, Note 3: Taxation revenue by type, p 38.
[2] CME, Climate Policy, published December 2024
[3] International Energy Agency (IEA), Global Critical Minerals Outlook 2024, May 2024.
[4] Government of Western Australia, 2023-24 Economic Indicators Resource Data File, Department of Energy, Mines, Industry Regulation and Safety, 29 October 2024. Investment refers to capital expenditure as measured by gross fixed capital formation at current prices. Australian Bureau of Statistics (ABS), 5220 Australian National Accounts: State Accounts, Table 25; 5206 Australian National Accounts: National Income, Expenditure and Product, Table 34.
[5] Business Council of Australia, Australia's flagging competitiveness and productivity, 19 November 2024, p 29. Productivity Commission, Trade and Assistance Review 2022-23, 24 July 2024, pp 31-32.
[6] ABS, 8104 Research and Experimental Development, Businesses, Australia, 2021-22 financial year, released 25 August 2023.
[7] Commonwealth of Australia, Sector Pathways Review, Climate Change Authority, 30 October 2024, pp 116-135. Australian Industry Energy Transitions Initiative, Pathways to industrial decarbonisation: Positioning Australian industry to prosper in a net zero global economy, phase 3 report, February 2023. State of Play, 2023 Mining Industry Survey: Trends shaping the future of mining, June 2024.
[8] We defer to the IEA's definition of produced in a near-zero emissions manner. Definitions for near-zero and low emissions steel and cement and underlying emissions measurement methodologies, 9 November 2024.

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This requires long-term investment in a broad range of technologies and projects as well as cross-sector collaboration and investment in shared infrastructure to improve margins and provide greater flexibility for the sector to pursue spending in areas like innovation.

We therefore welcome the independent expert panel's (the panel) strategic examination of Australia's R&D system to secure future growth in priority areas of the economy and strengthen resilience to compete in global supply chains. Principally, we support enduring whole-of-government initiatives that can effectively and efficiently address productivity barriers to private sector investment in Australia, inclusive of R&D.

Key recommendations

CME's recommendations to strengthen Australia's R&D system include:

- A technology-neutral, market and evidence-based approach to all government policies, both state and federal, to ensure sustainable outcomes for Australia's economy.
- The broadening of existing R&D incentives to support activities from early-stage prefeasibility to large-scale commercialisation pilots and demonstrations.
- Ensure continuity of funding to existing government programs to provide certainty for research institutions and industry beyond a single term of government, as research and commercialisation timeframes often extend past election cycles.
- Integrity and performance measures should be included in government programs and initiatives to ensure an outcomes-based focus on applied research that delivers value for end users and other beneficiaries.
- A continued focus on supporting science, technology, engineering and mathematics (STEM) education; better integration of curiosity and lifelong learning skills in education and training; and ensuring Australia's migration system can attract high-quality professionals across key areas.

Answers to the discussion paper's questions are provided in Appendix A. The contents of this submission reiterate views made by CME in the roundtable with the panel in February of this year, our 'Realising WA's green iron potential' report[9] and input to consultations on the Australian Government's FMA agenda, decarbonisation of the WA resources sector and development of strategic industries such as critical minerals and hydrogen. Also, see Appendix B for links to the relevant submissions.

In summary, CME supports an integrated, dynamic Australian R&D system that facilitates public-private collaboration to deliver sustainable and impactful outcomes.

Should you have any questions regarding this submission, please contact Aaron Walker, Head of Economics, on 0477 679 195 or A.Walker@cmewa.com.

Yours sincerely,

Adrienne LaBombard

Director of Policy and Advocacy

[9] Mandala Partners, Realising WA's green iron potential, report commissioned by CME, 9 December 2024.

Appendix A: Consultation questions

The below sections are structured in response to the discussion paper's consultation questions. Our views represent the WA resources sector, noting that many of CME's members also operate interstate and overseas.

1. What should an integrated, sustainable, dynamic and impactful Australian R&D system look like?

An integrated, sustainable, dynamic and impactful Australian R&D system should involve greater collaboration within and between different organisations and sectors of the economy. This should include greater coordination and alignment within and between the different levels of government on opportunities that can meaningfully facilitate private sector-led investment in national priorities to secure timely competitive advantages.

There have been no significant reviews of Australia's R&D system from the perspective of large businesses since 2016.[10] With the Australian Government's underlying cash balance forecast to be in deficit for the coming decade,[11] urgent action to drive higher productivity is required. The panel's review of opportunities to boost Australia's innovation and productivity performance is thus timely. In particular, the primary role of expenditure-based incentives like the R&D Tax Incentive (R&DTI) program for supporting business R&D in Australia, and whether additional income-based incentives should be considered part of the policy suite in future.[12]

2. What government, university and business policy settings inhibit R&D and innovation. Why?

The Australian R&D system and its underlying policy settings should better recognise that the private sector's propensity to innovate and the spillover benefits of such investment are influenced by a combination of internal and external factors such as:

- The existence of coordinated and consistent national priorities to support medium to longer-term investment into the R&D system (e.g. policies and funding independent of terms of government and budget cycles). Delivery of the FMA National Interest Framework will help address barriers associated with this, however, technology-neutrality is needed.
    - Achieving substantial emission reductions in sectors such as steel, cement and ammonia will likely require a robust R&D system that can fund medium to long-term investments across a balanced range of technology readiness levels (TRLs), with industry regulations that support retrofitting when new technologies become available.[13] On a case-by-case basis, government initiatives that focus on maturing a selected range of technologies with a lower readiness scale should be considered for expansion to include large-scale demonstrations where funding requirements are more significant to overcome in the final hurdles of commercialisation.
    - Policy design with business productivity at the front of mind can support innovation potential from the outset. This could include improving the dual administration of the R&DTI, addressing regulatory definitions of mining waste that limit circularity in the economy[14] and restrict the use of secondary co-products, or better consideration of upstream effects of the List of Critical Technologies in the National Interest on the Critical Minerals List. Reflecting this, **we strongly recommend that the panel consider the**

[10] Commonwealth of Australia, Review of the R&D Tax Incentive Review Panel Report, DISR, 4 April 2016. Review of the R&D Tax Incentive, Australian Small Business and Family Enterprise Ombudsman, December 2019. Administration of the Research and Development Tax Incentive, Australian National Audit Office, 25 November 2021. Koutsogeorgopoulou V and Park T, Boosting R&D outcomes in Australia, Economics Department Working Papers No 1391, Organisation for Economic Co-operation and Development (OECD), 8 June 2017.
[11] Commonwealth of Australia, Mid-Year Economic and Fiscal Outlook 2024-25, The Treasury, December 2024, pp 86-87.
[12] OECD, How do governments direct support for innovation?, policy brief, 17 September 2024.
[13] IEA, Demand and supply measures for the steel and cement transition: The case for international coordination, 19 March 2025, p 65.
[14] Productivity Commission, Australia's circular economy: Unlocking the opportunities, interim report, 5 March 2025, pp 118-123.

Productivity Commission's forthcoming findings and recommendations on opportunities in the circular economy.

- Investment in innovation can be linked to export activity and the capital intensity of current assets. In response to commodity cycles, most business models adopted in the WA resources sector rely on large-scale, low-cost production, established market positions and significant investments of over $1.7 trillion in private infrastructure.[15] The required cost of capital and lack of certainty in investment signals by governments can have a complex impact on decisions and their timeframes.
    - McKinsey estimates that a 50 per cent increase in mining capital investment is required compared to the previous decade to scale up the supply of minerals and metals to meet global demand beyond 2030.[16] Our WA green iron report finds that a capital investment of at least $37.5 billion is needed before 2030, with 54 per cent on renewable energy generation and storage and 23 per cent on iron production facilities.
    - The timing of a typical innovation cycle in the resources sector is between five and ten years.[17] This can result in a mismatch between timeframes for achieving technological maturity and commercial viability, readiness of public and private infrastructure to support fuel switching and electrification, approval processes for brownfield or greenfield projects, securing capital investment both domestically and overseas, and ability to meet sustainable financing conditions.
    - The evolving mandates of investors, superannuation funds, banks, bonds, venture capital funds and private equity in financing different investments and technologies.
- Limited access to highly skilled, productive workers can inhibit innovation. Over half of the ideas for innovation in the resources sector are sourced from within the business.[18] Government settings such as industrial relations, education and training impact business labour productivity. More flexible policies that encourage efficient unit labour costs and technology adoption can increase productivity and the propensity to innovate.
- The dynamism of interconnected actors to collaborate and commercialise faster (e.g. knowledge-intensive suppliers or customers and the sustainable integration of these partnerships with global supply chains).
    - In 2023-24, direct spending by CME members supported over 22,000 businesses across Australia, with an estimated gross value add of $117 billion to the national economy through supply chain effects.[19]
    - CME members also engage the research and scientific services of public agencies such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Minerals Research Institute of WA (MRIWA), the Chemistry Centre WA and the Bureau of Meteorology.
    - By industry in Australia, the resources sector is the third highest for collaboration with consultants for innovation, the highest for pursuing collaboration to conduct joint R&D, the third highest for introducing innovation that is 'new to the world' and the second highest for commercialising innovation via the acquisition of licences, rights and patents.[20] Caterpillar Inc, a construction, engineering and mining equipment manufacturer used by CME members, was the fourth highest international applicant for patents in Australia.[21] Also, see Appendix C for examples of collaboration on innovation.
- Given Australia's economic geography, foreign direct investment via offtake customers or suppliers of technological know-how to resource sector projects can impact innovation.

[15] For major projects, this has included foreign capital and State Agreement Acts to facilitate investment. Mining gross fixed capital formation, chain volumes; figures cover 2004-05 to 2023-24. ABS, Australian System of National Accounts, table 64.
[16] McKinsey & Company, How the energy transition could affect material supply chains, 5 July 2023.
[17] Global Mining Guidelines Group, State of Play of Circularity in the Mining and Metals Industry, white paper, 5 September 2024.
[18] ABS, 8158.0.006 Innovation in Australian business, 2022-23 reference period, 20 June 2024.
[19] CME, 2023-24 Economic Contribution Factsheets: Australia, 24 March 2025.
[20] ABS, 8158.0.007 Innovation in Australian business, 8158.0.010 Innovation in Australian business, 2022-23 reference period, 20 June 2024.
[21] Commonwealth of Australia, The structural change in patenting behaviour in Australia, IP Australia, analytical note, 6 November 2024.

Previously identified barriers to business spending on innovation as surveyed by the Australian Bureau of Statistics (ABS) – financial pressures, lack of access to additional funds, skilled workers within the business and in the broader labour market – continue to limit innovation today.[22] This national survey was also the first time the ABS asked about the environmental benefits of implementing innovation, with 33 per cent of all businesses and 45 per cent of large businesses reporting benefits.

This trend for larger businesses to place greater value on the environment is also reflected in 50 per cent of the employers in the resources sector viewing environmental stewardship as a core skill for their workforce in 2025.[23] This is expected to increase in importance by 2030.These figures are the highest of any industry and 2.5 times higher than the global average across all sectors.

Engaging the public focus on STEM more broadly will help build a national culture of innovation excellence and productivity in the workforce and economy.

3. What do we need to do to build a national culture of innovation excellence, and engage the public focus on success in R&D and innovation as a key national priority?

Government settings should be inclusive and holistic in addressing the different barriers to technological development, adoption and diffusion and broader cultural risks to capacity and capability to innovate. Studies indicate that a poor uptake of STEM subjects in schools can affect the proportion of the workforce with STEM-related higher education qualifications, adversely impacting the public focus on R&D success and an organisational culture of innovation.[24] Actions to address these challenges at a societal level should, therefore, assist in improving the national culture of innovation excellence and at the individual business level.

We also highlight that increasing burdens of regulation and safety compliance in small to medium-sized businesses (SMEs) may constrain innovation appetite.[25] By industry in Australia, the resources sector is the second highest in citing regulations as a barrier to commercialising innovation.

4. What types of funding sources, models and/or infrastructure are currently missing or should be expanded for Australian R&D?

We believe there are opportunities to expand the applicability of existing and recently announced funding sources and models, such as grant programs under the Australian Renewable Energy Agency (ARENA) and the R&DTI, to the entire R&D spectrum. That is, from prefeasibility studies and early-stage experimental development (e.g. small-scale laboratory research facilities) to large-scale commercialisation activities (e.g. pilot plants and demonstration trials).

Half of Australia's critical mineral projects were in WA, with a quarter of Australia's active hydrogen projects also in WA.[26] The Critical Minerals Production Tax Incentive and Hydrogen Production Tax Incentive are therefore welcome measures to help reduce the cost of doing business in Australia. However, recent delays to renewable hydrogen projects in WA and overseas[27] highlight that further support may be required. CME also supports technology-neutral funding programs or tax concessions to accelerate innovation and the deployment of low-carbon hydrogen supply.

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[22] ABS, Business innovation slows as economic pressures rise, media release, 20 June 2024.
[23] World Economic Forum, The Future of Jobs Report 2025, mining and metals industry profile, 7 January 2025.
[24] Ediriweera A and Wiewiora A, Barriers and enablers of technology adoption in the mining industry, Resources Policy, vol 73, October 2021. Commonwealth of Australia, Pathway to Diversity in STEM Review: Final Recommendations, Department of Industry, Science and Resources (DISR), 13 February 2024. Karltorp K and Perez Vico E, Factors influencing incumbent energy firms' radical innovations implementation: A review, Renewable and Sustainable Energy Reviews, vol 210, March 2025.
[25] Zhou X, Zhao Y, Zhao X, Xu J, SmutkaL and Bilan Y, Mineral resource drivers in the global south: A case study of Australia, Resources Policy, vol 92, May 2024. Commonwealth of Australia, Barriers to collaboration and commercialisation, Industry Innovation and Science Australia, DISR, November 2023, p 10.
[26] Commonwealth of Australia, Resources and Energy Major Projects 2024 Report, DISR, 31 October 2024 dataset, 20 December 2024. 26 of 93 hydrogen projects. CSIRO, HyResource: Industry active projects, 1 April 2025 update.
[27] IEA, Global Hydrogen Review 2024, 2 October 2024.

In 2021-22, $470 million in R&DTI expenditure was claimed by the mining sector,[28] making 53 per cent of total surveyed business expenditure on R&D. Noting the limitation of only one transparency report since the R&DTI expenditure cap and intensity thresholds came into effect in 2021, the panel should consider whether these reforms to the non-refundable tax offset have been effective in driving Australia's R&D intensity. If there are material funding gaps in the early and later phases of the TRL spectrum, this review should consider if there is a business case to expand the R&DTI to cover this type of expenditure.

We strongly support the use and expansion of existing special investment vehicles (SIVs) such as ARENA's $25 million Iron and Steel R&D funding round and $1.9 billion Powering the Regions Fund (PRF) as they are increasingly well-subscribed. We also note that the $1.7 billion FMA Innovation Fund is fully allocated.[29]

To maintain medium to long-term investment certainty for businesses and researchers, existing funding sources, models and infrastructure for conducting R&D in Australia must not be reduced. For example, we note the trend towards medium-term funding for SIVs and other government entities (i.e. ten years), helping to provide certainty and reduce the risk of repeal, consolidation or re-prioritisation of funding.[30] Any changes to the R&D system should be additional as competitors operate in economies with lower cost and regulatory structures, as well as favourable government R&D support. Overseas industrial policies to attract investment via government subsidies and export restrictions can structurally change supply chains and commodity markets,[31] locking in downstream technologies and impacting Australia's ability to compete internationally upstream in terms of cost.

Wherever possible, SIVs should balance medium to long-term priorities with the need to be dynamic and responsive to changing economic conditions and opportunities in the short term. ARENA's investment mandate can be limited in the application scale to early-stage R&D, full-scale conversions, demonstrations and deployments associated with the lowest and highest TRLs. Relative to gross domestic product, we highlight the Australian Aluminium Council's view that the magnitude of funding provided through the PRF is smaller than competing jurisdictions and support their view that it could apply to existing and new assets, both on and offsite investment.[32] We strongly support the recent announcement of the second round of the PRF $400 million Industrial Transformation Stream with its expanded scope to derisk the feasibility of first-of-its-kind technologies and commercial deployments,[33] albeit the available funding is half of the first round. However, there has been no evaluation of the effectiveness, efficiency and impact of ARENA's investments on the broader Australian economy since the recent material expansion of its funding.[34] With the capital-intensive nature of the energy transition across industries, there is an opportunity to review whether ARENA or other SIVs can support the derisking of technologies with higher impact across the medium to long term rather than a short-term commercialisation focus.

Where projects are of strategic advantage to securing Australia's future economic prosperity but do not directly align with a SIV investment mandate or are ineligible for prescribed FMA support consistent with the National Interest Framework, there should be discretion for flexibility in the declaration of a statement of expectations or something similar to allow extension of existing funds and programs on a case-by-case basis. Like the recently announced Green Aluminium Production Credit, which will be supported by section 33 of the *Industry Research and Development Act 1986* (Cth), or the Green Iron Investment Fund, additional government support may be needed to address the externalities associated with overseas competitors benefitting from lower energy and carbon costs.

We also do not support establishing new separate, standalone R&D infrastructure where existing research centres, institutes or facilities can be leveraged and better coordinated in capability and

[28] Commonwealth of Australia, R&D tax incentive transparency report 2021-22; R&DTI dataset, Australian Taxation Office, 3 October 2024.
[29] $750 million Green Metals Innovation Fund, $500 million Clean Energy Technology Manufacturing Fund and $250 million Low Carbon Liquid Fuels. Up to $200 million in additional resourcing budgeted for administration of the FMA Innovation Fund across the relevant government departments and ARENA.
[30] The bill lapsed at prorogation. Parliament of Australia, Australian Renewable Energy Agency (Repeal) Bill 2014, 2 September 2014. Department of Parliamentary Services, Bills Digest No 35: Australian Renewable Energy Agency (Repeal) Bill 2014, 17 October 2014.
[31] OECD, Economic Surveys: Indonesia 2024, 26 November 2024. Transnational Institute, The 'new Darwinian world' of the energy transition, 25 July 2024.
[32] Australian Aluminium Council, Aluminium: The original critical mineral and clean energy export, November 2023, p 11.
[33] ARENA, ARENA boosts funding support for industrial decarbonisation, news, 21 March 2025.
[34] EY, Evaluation of ARENA's impact and effectiveness, report prepared for ARENA, 18 November 2019. Commonwealth of Australia, Grant program management by ARENA, Australian National Audit Office, Auditor-General report no 35 2019-20, 30 April 2020.

scale.[35] Attracting ongoing research funding in fields of intense technological change and their commercialisation in the geopolitical context will be fierce (e.g. defence, military and battery storage). Like the approach in the United States, [36] any publicly funded initiatives to facilitate research commercialisation should be co-located in existing industrial clusters and be underwritten by an intellectual property (IP) holder or original equipment manufacturer with market share to support the sustainable development of a circular economy.

Like the issues that underpin the attraction of investors with major or transformational projects into Australia, what may be missing to a lesser extent is a single, more well-known interface for businesses unfamiliar with navigating Australia's business environment and R&D system to seek collaboration with willing industry partners and researchers. For example, public advisory services and grants target commercialisation in SMEs, and not all investors engage CSIRO in the first instance. In complementing how the new FMA Front Door will operate in practice, there is an opportunity to strengthen the focus of project-led facilitation services across similar and competing government portfolios, including the full range of SIVs.

5. What changes are needed to enhance the role of research institutions and businesses (including startups, small businesses, medium businesses and large organisations) in Australia's R&D system?

In our view, there needs to be an increased focus on technology-neutral applied research and its translation to commercial relationships with businesses.

Of global patent families related to low-emission steel, aluminium and iron ore technologies, 53 per cent have been on iron ore since 2015, while steel has seen the fastest growth in filings (i.e. direct reduced ironmaking, hydrogen reducing agents and carbon capture and storage).[37] It is positive to see this trend also reflected in research institutions in Australia, with MRIWA, the Heavy Industry Low-carbon Transition Cooperative Research Centre and ARENA increasingly drawing their attention to funding research in these areas relevant to the WA resources sector.

Across these patents in low-emission metals, China is the number one ranked origin, followed by the United States, Taiwan and Japan. Innovation in the WA resources sector can therefore be heavily influenced by trade relations and foreign direct investment. By applicant type, companies contribute to 67 per cent of patents in low-emission metals, with a high proportion to Chinese state-owned enterprises. This indicates that commercialising technologies in this sector largely lies with businesses rather than researchers. To ensure the economic performance of Australia's R&D system, the panel should seek to enhance the conversion of basic research into applied research.

In 2021, the Trailblazer Universities program was announced to translate university research into commercial-ready outcomes in partnership with the industry.[38] The Resources Technology and Critical Minerals Trailblazer (RTCM) was named the first to receive a share of the national funding with its inaugural showcase of 24 research projects over two years later.[39] It has since grown to 47 research initiatives.[40] However, of the 32 key projects publicly listed as approved for funding, despite the program's intent of being industry-led, 6 have no named industry partner at all.[41] The way that each trailblazer approaches collaboration with the industry can also be different.

In 2016, startup Sapien Cyber was launched to commercialise cybersecurity university research.[42] Three years later, the startup secured equity stakes from the university and the industry.[43] Another

[35] For example, additional funding was allocated to the Australian Critical Minerals R&D Hub hosted by CSIRO with partners Geoscience Australia and the Australian Nuclear Science and Technology Organisation. Grant to support international R&D for critical minerals, ministerial media release, 18 July 2024.
[36] United States Economic Development Administration, Biden-Harris Administration Designates Tech Hub in South-Central Missouri to Drive Innovation in Critical Mineral Processing to Support Battery Technology, media release, 23 October 2023. Das D, Role of the State in the Energy Transition: The Case of China and Lessons for the United States, 24 October 2023.
[37] Commonwealth of Australia, Patent analytics on low emission technologies, interactive visualisations, IP Australia, 29 September 2022.
[38] Commonwealth of Australia, Trailblazer universities to build jobs of the future, joint ministerial media release, 24 November 2021.
[39] RTCM, Inaugural Trailblazer Showcase, 1 May 2024.
[40] RTCM, Trailblazer announces $102 milllion funding commitments, 19 November 2024.
[41] RTCM, Funded projects, accessed 31 March 2025.
[42] The West Australian, Edith Cowan University claims $1.3m from tech venture Sapien Cyber, 22 March 2024.
[43] Woodside Energy, Woodside invests in WA cyber security solution, media release, 18 March 2019. The West Australian, Administrators of Sapien Cyber will consider selling the Joondalup tech company, 4 March 2024.

five years later, it entered voluntary administration after a year of raising capital to offset the loss of key contracts and significant changes to its board.[44] Despite also receiving profile support from the WA Government,[45] the challenges of translating research into a commercial reality contributed to its winding up. In the panel's consideration of how to support basic and applied research, it is therefore vital that startups and SMEs also receive strategic advisory advice, including innovative financing solutions like technology-focused venture capital funds, on how to make it past the phase of negative cash flows to compete on the global stage.[46]

Achieving positive, stable cash flows will require strategic advice on sustainably diversifying revenue (i.e. securing new customer contracts). Like our views on government assistance to secure offtakes and improve price transparency for critical minerals and green metals in opaque markets, this may require greater support to startups and SMEs to access and attract investment funds, seek strategic collaborations or establish joint venture relationships with potential customers.

With the implementation of the government's response to recommendations of the Universities Accord Report underway and the delivery of the University Research Commercialisation Action Plan,[47] the panel should conduct an interim review of these higher education reforms to ensure they deliver value for businesses as end users of Australia's R&D system.

6. How should Australia support basic or 'discovery' research?

Basic or 'discovery' research on concept validation should be supported by requiring a stronger demonstration of its nexus to end users, beneficiaries and real-world outcomes (i.e. significance of the research and why it should be funded). For example, it could be further developed for industrial application as the TRL progresses or is expanded to other supply chains.

We note that basic research topics can follow the terms of government and societal expectations. A longer-term funding approach beyond more than one term of government across the range of priority areas is needed. Similar to funding provided to ARENA and Geoscience Australia, it may be beneficial to consider the provision of funding over a 10-year horizon.

7. What should we do to attract, develop and retain an R&D workforce suitable for Australia's future needs?

Domestically, we recommend a greater focus on modernising STEM subjects for broader school uptake as a foundation for developing skills for lifelong learning. Where skills are not available locally, we must ensure Australia's migration system can attract high-quality professionals, including researchers, across a range of national priorities. Any efforts to attract, develop and retain an R&D workforce suitable for Australia's future needs should take a whole-of-economy approach to building capacity, including coordination with the Net Zero Economy Authority's regional transition plans.

The resources sector ranks as one of the top employers for STEM-qualified occupations such as engineers (i.e. mining, petroleum, chemicals and materials), geologists, geophysicists and hydrogeologists, technicians (i.e. building, engineering and science), metal fitters and machinists, and chemical, gas, petroleum and power plant operators.[48] For over half of these occupations, WA is also the leading employer across states and territories. Access to highly skilled and productive workers across these occupations is critical to the safe and viable operations of resource sector projects. External factors such as industrial relations and skilled migration policies can impact business labour productivity and innovation within and between businesses and industries.

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[44] WAtoday, Big backers' U-turn sends Edith Cowan cybersecurity firm into administration, 5 March 2024. Business News, Sapien Cyber to be wound up, 16 April 2024.
[45] Government House Western Australia, Cyber security launch, visit to the Police Tech Crime unit, and a dinner for the new ASIC Chair, 20 May 2021. Department of Jobs, Tourism, Science and Innovation, INDOPAC 2023: Quad chart for Sapien Cyber, 31 October 2023.
[46] Reserve Bank of Australia, Financing SME Innovation in Australia: Challenges and Opportunities, speech, 4 April 2024.
[47] Commonwealth of Australia, Australian Universities Accord: Final Report, Department of Education, 21 February 2024, p 54.
[48] Over 50 occupations where more than half of Census respondents declared a STEM qualification. Commonwealth of Australia, Methodology: STEM Equity Monitor, DISR, 26 July 2024. Jobs and Skills Australia, Occupation data, table 5 and 6, 12 November 2024.

The vocational education and training (VET) to higher education pathway is a small but increasingly popular alternative pathway to increase the participation of women in engineering disciplines. We also note the Universities Accord Report recommends encouraging and assisting TAFEs to become self-accrediting in higher education in national priority areas such as digitalisation and net zero (e.g. electrotechnology specialisations).

Further to the Universities Accord Report, we also support a nationally consistent approach to the recognition of prior learning, credit recognition and work-integrated learning projects in TAFEs and higher education that provide exposure to technological changes. However, public-private collaboration to improve training and learning outcomes with on-the-job experiences, including retraining for new skilling priorities, may require incentives to balance workforce productivity. Currently, CME members sponsor internships and scholarships as pre-employment pathways to attract talent to the industry.

We also draw the panel's attention to the World Economic Forum's survey on business and workforce transformation to 2030, which found that 45 per cent of employers in Australia view changes to immigration policies will have the greatest potential to increase talent availability (almost twice the global average), helping to address key expected barriers such as an inability to attract talent to the industry.[49]

For the mining and metals sector globally, 69 per cent of employers expect increased efforts to reduce emissions as the greatest macrotrend in driving business transformation, with 31 per cent anticipating increased government subsidies and industrial policies such as trade restrictions to also impact.[50] By technology trend, 79 per cent expect energy generation, storage and distribution (almost twice the global and Australia averages) and 66 per cent expect new materials and composites to drive transformation within their organisations (almost thrice the global and Australia averages). This view on the impact of technologies is also reflected in Australia's growth as a destination market for patent filings on clean energy generation and storage.[51] In contrast, a lower share of the resources sector expect artificial intelligence and information processing technologies to drive transformation (66 per cent versus the Australia average of 94 per cent), reflecting the sector's leading uptake of digital technologies such as big data analytics and the internet of things.[52]

8. How can First Nations knowledge and leadership be elevated throughout Australia's R&D system?

There may be an opportunity to elevate First Nations knowledge and leadership throughout Australia's R&D system by building capacity and relationships in partnership with Traditional Owners, Aboriginal corporations, registered training organisations and other relevant state agencies. In 2023-24, CME members supported over 600 businesses that are majority Indigenous-owned, controlled or managed. The WA and Australian Governments have also committed funding to assist Traditional Owners in engaging with the developers of clean energy projects, including providing support for training and skills. Responsible access to land, that balances economic and environmental considerations with community expectations like Aboriginal cultural heritage, is fundamental to the pace of the energy transition.

9. What incentives do business leaders need to recognise the value of R&D investment, and to build R&D activities in Australia?

We acknowledge that a supportive R&D system in Australia is a shared responsibility of governments, businesses and research providers. Like any sector, the quantity and quality of tangible (e.g. hardware, machinery and equipment) and intangible capital (e.g. managerial know-

[49] World Economic Forum, The Future of Jobs Report 2025, Australia country profile, 7 January 2025.
[50] Employers in the oil and gas industry also have similar views on the impact of technologies. World Economic Forum, The Future of Jobs Report 2025, mining and metals industry profile, 7 January 2025, p 14, 15, 36.
[51] Commonwealth of Australia, Australian IP Report 2024, IP Australia, May 2024.
[52] ABS, 8167.0 Characteristics of Australian business, 2021-22 reference period, 22 June 2023, table 1.

how,[53] IP and the education level of employees) are factors that can influence the value of R&D investment. To ensure value for taxpayers' money on public investment, R&D incentives should be designed with the end users and other beneficiaries in mind.

There is no one-size-fits-all approach to attracting and building R&D activities in Australia. A whole-of-government approach should be broad-based and focused on ensuring globally cost-competitive settings so that marginal returns on R&D investment or early mover advantages do not diminish. In 2024, Australia's lowest-ranking key attractiveness factors were: effective labour relations, R&D culture, cost competitiveness and competitive tax regimes.[54] A broad approach to reducing business cost inputs, such as effective corporate income tax rates or accelerated tax deductions for capital assets to help lower the costs of energy and facility retrofitting, should help improve the propensity for business leaders to invest in R&D. We also note that grants may be better suited for incentivising targeted segments of the value chain that are less capital intensive.[55]

To supplement broad-based incentives, eligibility for more decarbonisation scenarios and technologies in future funding rounds of existing competitive grant programs should be considered. Direct, targeted incentives for technology-specific pathways, such as the Hydrogen Headstart and other ARENA programs where Australia is likely to sustain a comparative advantage, are welcome. However, the panel should consider expanding existing or new incentives for promoting technology-neutral R&D investments. Diversifying the breadth of research will increase the probability of identifying commercially viable options and improve alignment with investment cycles and transition timeframes.

For CME members whose emissions are hardest to abate at scale, the current option for deployment with the highest TRL is pre- or post-combustion carbon capture, use and storage (CCUS). These members support acknowledging CCUS as a critical technology option in government policies. There may also be an opportunity for CCUS to play a role in emerging value chains such as low carbon liquid fuels. Similarly, some CME members see growing research opportunities to sequester carbon dioxide through mineralisation technologies.

We draw the panel's attention to recent research by the International Monetary Fund (IMF) that suggests industrial policies, with subsidies and export incentives, targeting specific sectors can boost technological transfer patenting in the short term.[56] While Australia has largely benefited from foreign patents linked to the technological advantage of the resources sector, it has complemented domestic innovation more broadly and enabled diversity in production over the last century.[57] Should there be a robust business case with a demonstrated net public benefit, Australia could similarly benefit if strategic industries, such as critical minerals and green metals, are appropriately targeted to improve their ability to compete with overseas jurisdictions. This may also include a review of the R&DTI to ensure commercial-scale R&D activities can be built and retained in Australia. The IMF research also highlights that good business environments and more educated workforces can enhance economic performance and innovation sparked by industrial policies.

Noting the structural shifts in which firms hold domestic patents,[58] ARENA's existing funding requirements for public knowledge sharing and the role of FMA decision makers in considering 'how the project will share knowledge and contribute to Australian innovation', the panel should be aware that businesses may need upfront certainty on IP protections before committing to R&D investments. There is an IP framework and toolkit to help businesses collaborate with universities. However, there is no consistent approach across government agencies to collaboration and ensuring that sensitive information related to private sector research and commercialisation projects remains confidential. Upfront openness to sign non-disclosure agreements can also vary.

[53] Knowledge of digital technologies and specialist skills in business management are factors for innovation in the mining industry. ABS, 8158.0.006 Innovation in Australian business, 2022-23 reference period, 20 June 2024.
[54] International Institute for Management Development, Competitiveness Profile: Australia, World Competitiveness Yearbook 2024, June 2024.
[55] Aluminium value chains are capital intensive and have high debt-to-asset ratios when compared to technology-oriented sectors that attract government grants. OECD, Government support in industrial sectors: A synthesis report, OECD trade policy paper no 270, 7 April 2023., p 14.
[56] Baquie S, Huang Y, Jaumotte F, Kim J, Machado Parente R and Pienknagura S, Industrial policies: Handle with care, Staff Discussion Notes No 2025/002, International Monetary Fund, 21 March 2025.
[57] Fleming F, Liu ZF, Merrett D and Ville S, Australian innovative activity and international technology, 1854–2016 European Review of Economic History, vol 28, May 2024, pp 563-588.
[58] Commonwealth of Australia, The structural change in patenting behaviour in Australia, IP Australia, analytical note, 6 November 2024

10. What should be measured to assess the value and impact of R&D investments?

Findings from the 2019 Innovation Metrics Review remain relevant to what should be measured to assess the value and impact of investment in innovation.[59] As the primary policy tool for incentivising R&D in Australia, the measurement of R&D through surveys may be underrepresented as it can be limited to the respondents' understanding of existing R&DTI definitions.

Also, see Appendix D for our rated importance on the discussion paper's statements.

[59] Commonwealth of Australia, Improving Innovation Indicators: Better Data to Track Innovation in Australia, DISR, 2019, pp B10, C17 and C19.

Appendix B

A non-exhaustive list of CME submissions, position papers and reports relevant to R&D priorities in the WA resources sector.

Strategic industries

- Green metals consultation paper, submission to DISR, 17 July 2024.
- WA's Battery & Critical Minerals Strategy: Stakeholder consultation paper 2023, submission to the WA Department of Jobs, Tourism, Science and Innovation (JTSI), 14 December 2023.
- WA Renewable Hydrogen Strategy Refresh: Stakeholder consultation paper 2023, submission to JTSI, 20 October 2023.
- National Hydrogen Strategy Review: Consultation paper, submission to the Department of Climate Change, Energy, the Environment and Water (DCCEEW), 22 August 2023.
- Critical Minerals List Submission, submission to DISR, 16 August 2023.
- Accelerating opportunities in WA's critical minerals sector, position paper, 17 June 2023.
- Australian Critical Minerals Strategy 2023: Discussion paper, submission to DISR, 13 February 2023.
- Towards competitive clean hydrogen, position paper, November 2021.
- National Manufacturing Priority: Critical minerals processing roadmap, submission to DISR, November 2020.

Climate and energy

- Transport and Infrastructure Net Zero Roadmap, submission to the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), 26 July 2024
- Unlocking Australia's low carbon liquid fuel opportunity, submission to DITRDCA, 17 July 2024.
- Australian Sustainable Finance Taxonomy Consultation Paper, submission to the Australian Sustainable Finance Institute, 5 July 2024.
- 2024 Issues paper: Targets, pathways and progress, submission to the Climate Change Authority, 21 May 2024.
- Electricity and Energy Sector Plan, submission to DCCEEW, 3 May 2024.
- Carbon leakage review: Consultation paper, submission to DCCEEW, 12 December 2023.
- Future Gas Strategy: Consultation paper, submission to DISR, 13 November 2023.

Other

- Establishing a Front Door for major transformational projects, submission to The Treasury, 7 October 2024.
- Diversity and Inclusion in the Western Australian Resources Sector, report, September 2024.
- Activating WA's Strategic Industrial Areas, report by the Australian Venture Consultants, July 2024.
- Future Made in Australia Bill 2024 and Future Made in Australia (Omnibus Amendments No 1) Bill 2024: Provisions, submission to the Senate Standing Committees on Economies, 30 July 2024.

Appendix C

A list of some of the recent innovation-related initiatives that member companies have been involved in through private collaboration, public-private collaboration and SIVs. Note: This is a non-exhaustive list of examples in the last two years.

1. Industry-led collaborations	Member companies directly involved
Global Mining Guidelines Group A not-for-profit organisation that facilitates global, multi-stakeholder collaboration to accelerate and de-risk the implementation of new and best practices, technologies and processes in mine operations to improve the safety, sustainability and productivity of the mining industry.	Alcoa Anglogold Ashanti BHP CITIC Pacific Glencore Gold Fields Australia Mitsubishi Corporation Newmont Orica Rio Tinto South32 Thiess
NeoSmelt consortium: An ironmaking electric smelting furnace pilot plant with BlueScope	BHP Rio Tinto Woodside Energy
Battery-electric haul truck trials with Caterpillar and Komatsu	BHP Rio Tinto
Australian Remote Operations for Space & Earth with Curtin University, University of Western Australia and Deloitte	Woodside Energy Rio Tinto
Delithiated Beta Spodumene: Evaluating the potential use as a co-product of processing lithium ore as a road building material with the Australasian Pozzolan Association, MRIWA and ChemCentre	Albemarle Covalent Lithium Tianqi Lithium
Electric Mine Consortium: Mobilise equipment trials across locations and launched a simulation crowd challenge Note: Although now concluded.	Bellevue Gold BHP (indirectly via acquisition of Oz Minerals) Evolution Mining Gold Fields Iluka Resources Newcrest Mining South32
Blue Ocean Marine Tech Systems: Commercialise IP for marine seismic surveys	bp Ventures Woodside Energy

2. Research organisation-led collaborations	Member companies directly involved
Future Battery Industries Cooperative Research Centre • Stage 2: Cathode precursor production pilot plant • Electrochemical testing of Li-ion battery materials in standard cell formats	BHP Nickel West IGO Limited Iwatani Corporation (indirectly via partnership with Cobalt Blue Holdings)
Resources Technology and Critical Minerals Trailblazer (RTCM)	Evolution Mining Gold Fields Australia IGO Mineral Resources Limited South32 Woodside Energy
Future Energy Exports Cooperative Research Centre	bp Chevron INPEX Australia Mineral Resources Rio Tinto Woodside Energy
Minerals Research Institute of WA (MRIWA) Use of industrial tailings as an alternative to virgin sands, with ChemCentre	Albemarle Covalent Lithium Mineral Resources Limited Northern Minerals
Heavy Industry Low-carbon Transition Cooperative Research Centre • Intermediate product exports for Australia-China green steel with MRIWA • Analysis of market, cost and locational factors for green iron and steel in Australia with MRIWA	Fortescue Roy Hill
Cooperative Research Centre for Transformations in Mining Economies • Improved prediction, remediation and closure of acid and neutral metalliferous drainage sites with MRIWA	BHP Fortescue Newmont Rio Tinto
Chemistry Centre WA Phase 2: Validation and standardisation of sequential leaching tools to better predict the impact of iron ore mining on ground and surface water quality	BHP Fortescue Rio Tinto
3. R&D funding sources	Member companies directly involved
ARENA Iron and Steel R&D funding rounds	BHP

	Fortescue Roy Hill
ARENA PRF SafeguardTransformation Stream	Simcoa
ARENA Hydrogen Headstart	Intercontinental Energy (indirectly through Copenhagen Infrastructure Partners)
Clean Energy Finance Corporation	Liontown Resources Orica (NSW)
WA Government's Investment Attraction Fund	Australian Gas Infrastructure Group Pilbara Minerals Yara Pilbara Fertilisers (indirectly through YURI)

Appendix D: Survey questions

The following is our collective rated importance of the provided statements on Australia's R&D system. Note: Individual CME members will rate each statement differently according to their commodity, project lifecycle, size and nature of their business, position in the supply chain and market share.

Statement	Importance
R&D is important for economic diversification.	Strongly agree
Increasing R&D investment by the business sector is the most critical element to improving the economic impact of Australian R&D.	Strongly agree
Maintaining investment in foundational R&D is critical to the overall health of the R&D system.	Agree
Public R&D resources should be more targeted towards national priorities.	Agree
New and alternative sources of R&D funding are needed.	Strongly agree
First Nations knowledge is sufficiently reflected in the R&D landscape.	Neutral
Research institutions should be more specialised with more clearly defined roles.	Agree
The current R&D workforce can address Australia's future needs.	Disagree
Better coordination is needed to manage R&D infrastructure.	Agree
Government should play a larger role in spurring collaboration and alignment of cross-sector interests.	Agree