

SENIOR LEADERS EVENT

Transformation highlights: Research to support WA Future State

Hosted by the CRC TiME Board

25 March 2024





ACKNOWLEDGEMENT OF COUNTRY

Find about our actions towards First Nations Inclusion:
crctime.com.au/research/first-nations-inclusion



You're part of:

Australia's largest collective investment in reimagining and transforming what happens when mining ends.

- The world's only research organisation dedicated to mine closure.
- A network of more than 75 partners unlocking innovation by:
 - connecting diverse ideas, people, disciplines, organisations, regions and sectors.
 - undertaking globally-leading and nationally important research.
 - developing and investing in education and training for current and future research, industry, First Nations, community and government leaders.





You're part of:

A cooperative to support impact so:

- mines are closed in ways that deliver social, economic & environmental value.
- closed sites are repurposed to enable faster transition and resilient economies.
- mine closure business solutions drive new commercial, regional and First Nations opportunities.
- there is continued investment in Australian resources.
- policy, decision and management systems reduce risks for people, communities, industry and nature.





Progress snapshot

- 28 projects completed, including our landmark portfolio of foundational projects.
- 23 projects underway.
- Two proposals and six concepts in development.
- More than 2,200 publications downloaded in 2023.
- Partnerships and engagement across Australia.
- Strengthening global connections and national reach.



Beyond closure: A transformative research agenda



An agenda for change

- Examining what ‘post-mine transition’ means to different groups and developing shared understanding, particular with First Nations.
- Facilitating a shift from site to regional scale.
- Developing new ways to understand and incorporate values into post-mine planning and actions.
- Bringing together engineering and biophysical dimensions with social, cultural and economic aspects.

Global reach

- Cambridge University Press [‘Research Directions’ – Mine Closure and Transitions Journal.](#)
- NSF Global Coal Transitions Research Coordination Network.
- [International Network of Acid Prevention](#) partnership.
- World Mining Congress, ICMM Responsible Leaders Forum, International Mine Closure Conference and more.
- Globally accessible and shared published resources and webinars.

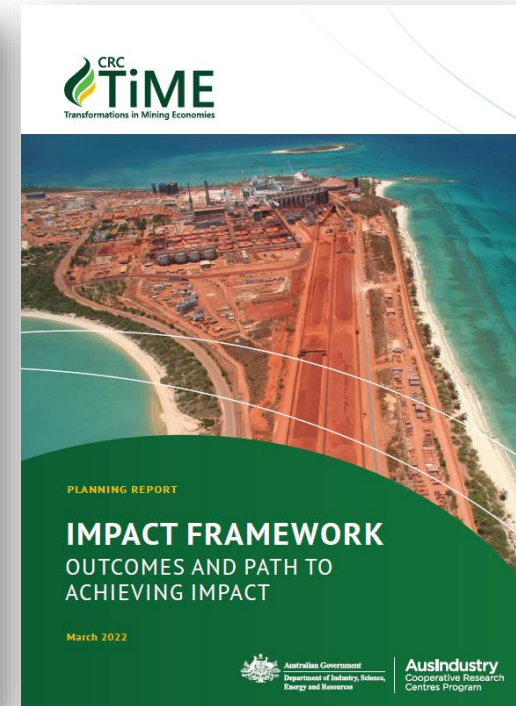
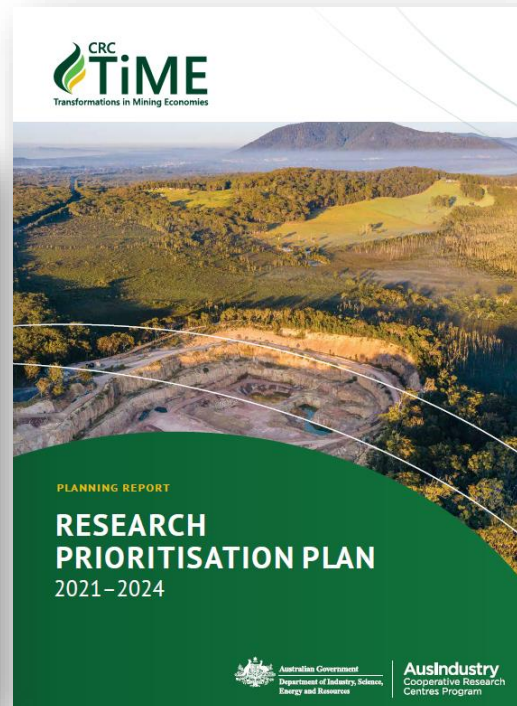


Work underway across ESG dimensions (highlights)

Dimension	Areas of work include
Environmental	<ul style="list-style-type: none"> • Technical guidance on mine pit lakes • Technical guidance to prevent and manage AMD/NMD • Natural capital assessment, accounting and forecasting for enhanced integration into decision-making • First demonstrations of climate-adapted seed sourcing strategies • Australian seed-scaling initiative
Social (including cultural and economic)	<ul style="list-style-type: none"> • First Nations VET pathways • Understanding stakeholder values in the context of transition • Tools to help identify capacity drivers and undertake scenario planning for economic transitions • Understanding community aspirations and approaches for engaging about mine pit lakes • Understanding enablers for First Nations to negotiate, partner and engage on mine closure • Post-mine land use planning and enabling economic post-mine transitions
Governance	<ul style="list-style-type: none"> • Mapping of mine closure regulation (Western Australia, Victoria and Queensland) • Different models for Regional Cumulative Effects Assessments and Management, including Indigenous-led assessments (framework, typology, case studies) • Collaborative planning approaches for post-mine development (Latrobe Valley, with national lessons) • Comparative analysis of mine closure guidance and residual risk transfer models • Multi-criteria optimisation framework based on CRC TiME values research

2024: Refreshed strategy

Much has changed since CRC TiME was formed.
We will collaboratively update our strategy in 2024.



Future State

Our contributions to a smarter, more sustainable and diversified economy for Western Australia.



In focus: Western Australia

Around 100 Western Australian mines are projected to close by 2040.

Our portfolio and engagement spans Western Australia with highlights including:

- ‘Mine closure solutions’ - a green industry growth opportunity.
- Flagship \$10 million project to address AMD/NMD.
 - Aim to update AMIRA Guidebook (2002).
- Field studies as part of world-first climate adapted seed sourcing trial.
- A national initiative to improve pit lake management.
 - Includes landmark component to understand First Nations and regional community aspirations.
- Regional cumulative effects assessment and management.
 - Case studies, typology, Indigenous-led assessments, pilot studies.
- Understanding transition capacity drivers and regional economic pathways.
 - Developing tools, knowledge and resources.
 - Pilbara and Bowen Basin case studies.



Tackling AMD in waste management - Mining Magazine Australia
miningmagazine.com.au • 7 min read

SCIENCE, INNOVATION AND TECHNOLOGY



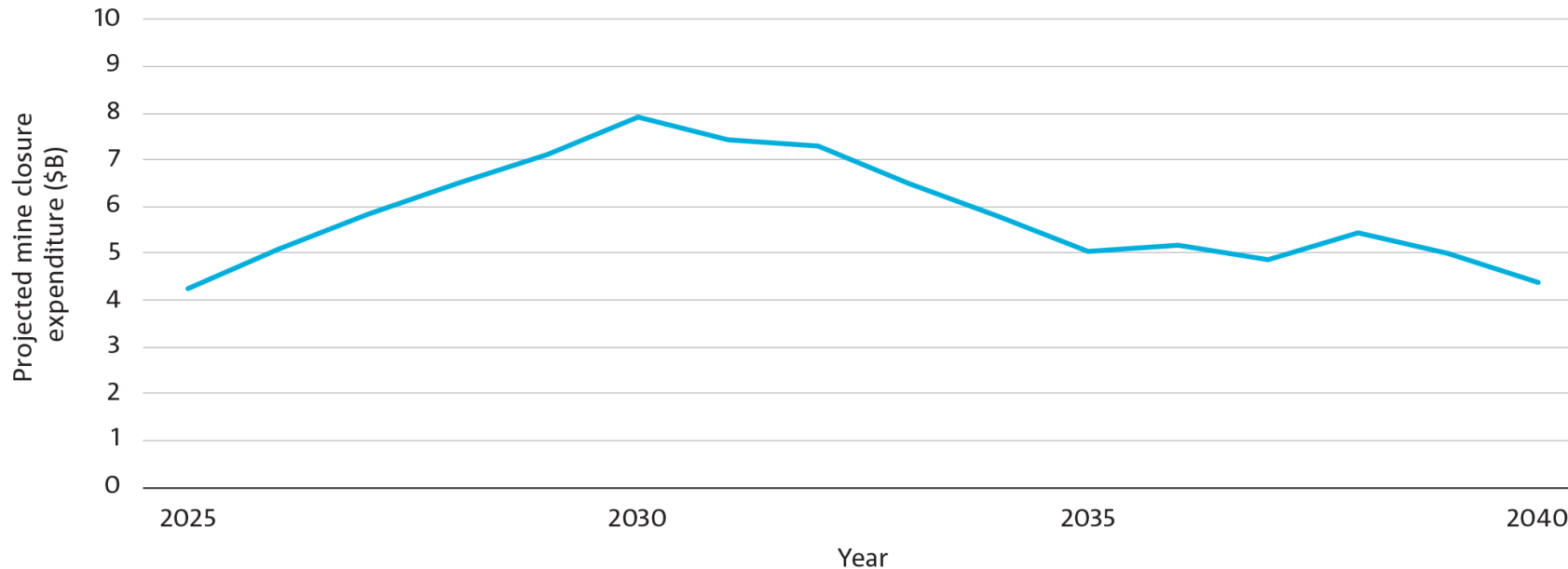
In focus: From gas decommissioning to mine closure solutions

- Broad recognition of significant potential for gas decommissioning industry (e.g estimated \$60 billion activity over next 30 to 50 years).
- **What if we looked at mine closure the same way?**
- Australia has the opportunity to become a global supplier of solutions that improve outcomes and reduce the costs of mine closure and transitions.
- New report identifies a portfolio of key opportunities:
 - from facilitation services for complex stakeholder engagements... to technologies to characterise and recover minerals from waste.
 - including the growth of businesses specialising in identifying, assessing, enabling and developing post-closure land uses.





In focus: Opportunities for Australian industry



- Almost 240 Australian mines projected to complete operations by 2040.
- Estimated **more than \$4 billion - \$8 billion annual expenditure** on mine closure activities annually to 2040.
- Opportunities across diverse business areas – potential to turn into global growth.

CSIRO Futures calculation; S&P Global Market Intelligence 2023, S&P Capital IQ Pro, Asset Data, Metals & Mining Properties, Australia. Graph displays a 5-year moving average trendline, so 2021–2024 data points are omitted. 2025 data point is interpreted as average expenditure from 2021–2025 and so on.

Science, innovation and technology

Engagement and partnership

Solutions that enable effective engagement, co-design, and mutually beneficial partnerships to improve social performance, reduce social and governance risks and optimise outcomes.



Waste reduction and resource recovery

Solutions that enable cost-effective reduction, reuse, and recycling of mine waste to minimise closure liabilities, residual risk, and ongoing maintenance costs.



Mine closure solutions

Mine rehabilitation

Solutions that improve the performance or cost-effectiveness of mine rehabilitation activities to ensure that mined land is safe, stable, non-polluting and able to support an appropriate land use.



Land use transitions

Solutions that address challenges preventing the establishment of post-closure land uses on mined land to generate lasting social, environmental and economic value and offset the costs of managing ongoing liabilities.





In focus: What's next

- Huge opportunities for diverse equipment, technology and services suppliers including:
 - software development
 - co-design and partnership facilitation
 - asset repurposing
 - business development
 - land rehabilitation
 - resource recovery and reprocessing
 - waste reduction.
- To maximize the opportunities for the mine closure solutions industry, coordination is needed across mining industry, new MCS industries and government.
- A suite of key actions are presented in the report.

Hannans North Tourist Mine Kalgoorlie, WA

Historic gold mine converted into a visitor attraction and educational site.



Clean energy hub Kidston, QLD

Gold mine under transition to develop renewable energy generation and storage site with solar, wind and pumped hydro technologies.

Image: Genex Power



Woodlawn Eco-Precinct Tarago, NSW

Open-cut mine pit converted into a bio-reactor landfill creating bio-gas to fuel a power generator. Site also holds aquaculture facilities, solar and wind farm.

Image: Veolia



Lake Kerpwari Collie, WA

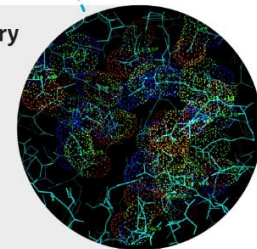
Recreational lake that was created from conversion of a coal mining pit via local river diversion.

Image: CRC TiME



SUPL: Stawell Underground Physics Laboratory Stawell, VIC

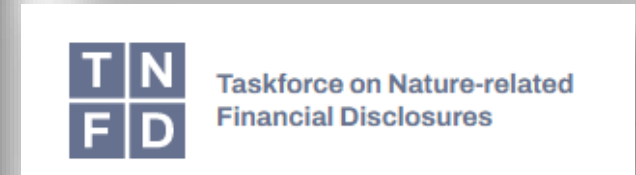
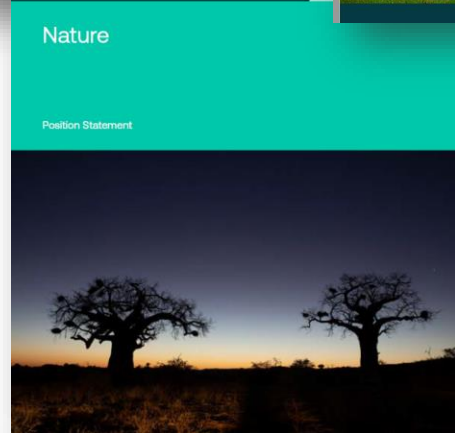
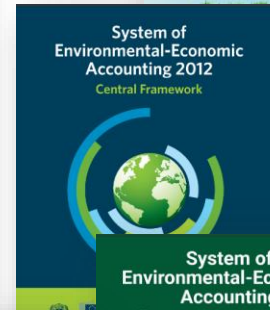
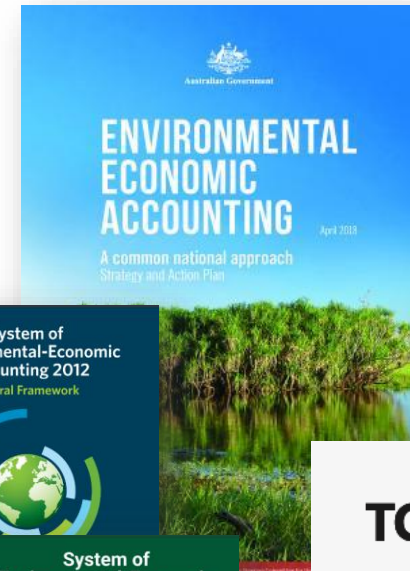
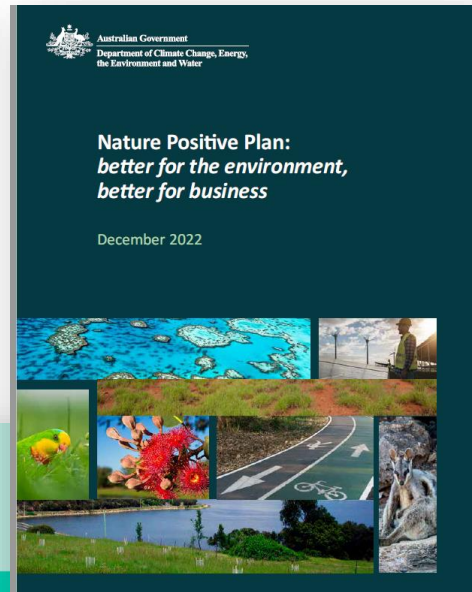
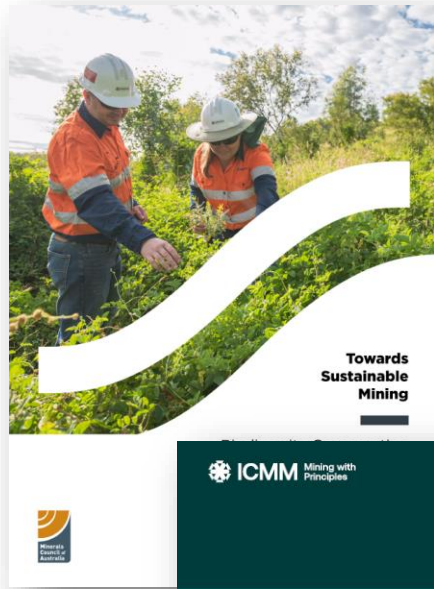
Laboratory located in an operational gold mine 1km underground, where conditions are optimal for research into dark matter, neutrinos and geoscience.



ESG FRAMEWORKS

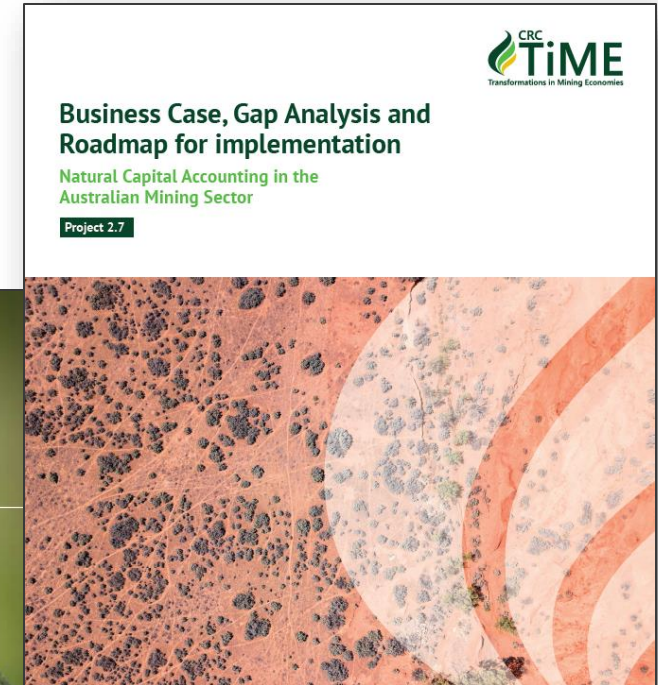


Growing global and national focus on nature



In focus: Natural Capital Accounting in the mining sector

- Australian-first suite of resources to support industry preparedness and implementation.
- Initiated by Department of Climate Change, Energy, the Environment and Water with CSIRO.
- Resources suite includes:
 - a business case
 - gap analysis
 - roadmap to develop knowledge, capability and
 - case studies.
- Work underway to develop next phase through an NCA Consortium.



In focus: Natural Capital Accounting in the mining sector

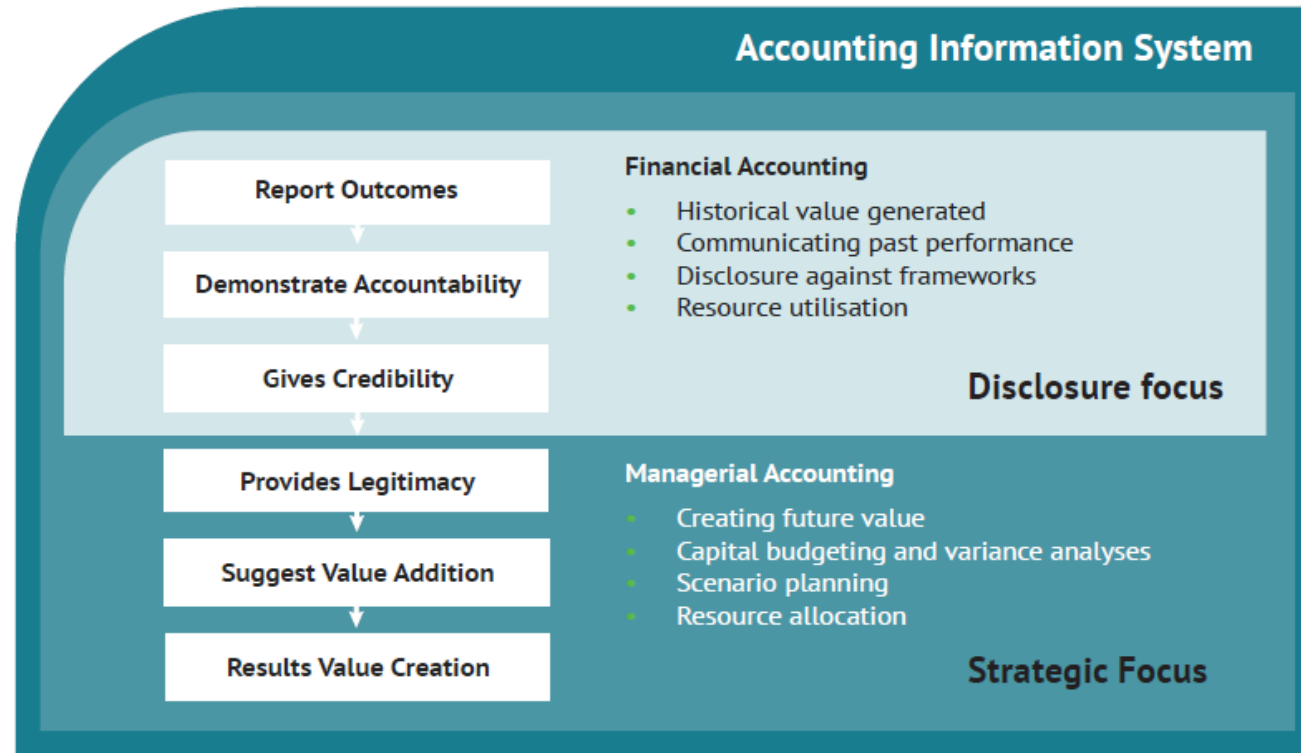


Figure 1: Components of an Accounting Information System

Where to from here?

Theory to Practice

BHP Nature Positive

- The biodiversity challenge

South 32

- Expanded NC reporting

Integrated reporting

- Extended financial statements

User testing

- Does anyone care?
- Is it useful?
- Does it help?

Mainstream

Data/information sharing

- SEAF/Nature Intel/EEA dashboard

Risk/opportunity analysis

- Nature based solutions

AI/ML

- Workflows, provenance, change detection

Valuation

Decision evaluation

- Nature-based solutions, regional planning, cumulative impact assessment

Social cultural values

- Social capital accounting, assessment, Indigenous Knowledge Systems

Equitable

Digital inclusion

- Cost, accessibility, equity, transparency

Protection and privacy

- Fair and just, not punitive, assurance, and auditing.

Building capability

SKILLED AND PRODUCTIVE WORKFORCE



Skilled and productive workforce

- Training and education is needed to address the mine closure challenge.
- Working to meet demands of:
 - mining and mining equipment, technology and services workforce
 - first Nations and regional communities
 - public service professionals
 - research community.

Our approach

- Undertaking a strategic review of education and training options.
- Broadening availability of quality low cost and accessible education.
- Indigenous-led project to understand and develop VET suite for First Nations.
- Investing in future leadership through HDR Top-Up Scholarship Program.
- Facilitating collaboration.





In focus: Understanding for collaboration

Australian picture

- Only 36 professional development courses cover mine closure in some form (two specifically).
- 15 higher education units with mine closure as a learning outcome.
- No VET currently available.

Strategic review of education and training options

- By Australian Mining and Automotive Skills Alliance – a Jobs and Skills Council (released shortly)

Building support for greater cooperation

- Hosting a Community of Practice.
- Virtual Education and Training Roundtable in February.
- In-person workshop, Adelaide, May 2024.
- Integrating into 2024 Forum Program.

Identifying higher education opportunities

- Specialist skills requirements.

In focus: First Nations VET Pathways (Stages 1 and 2)

Indigenous-led project to develop VET products relating to mine closure and post-mine transitions.

- Indigenous Steering Group
- Focus on skills and knowledge to:
 - support negotiation and working with mining companies.
 - develop business enterprises.
 - maximise employment opportunities.
 - Support mining-related income.
- Includes supply and demand analysis.
- Community workshops to commence soon.
- Coordinating with the Australian Mining and Automotive Skills Alliance.




In focus: Expanding availability of quality low-cost education

Mass Open Online Course on Foundations of Mine Closure and Sustainable Transitions


- World-first course developed by Curtin University and The University of Queensland.
- Free baseline learning in beta version.
- International interest: enrolments from over 30 other countries.
- Excellent retention rate of 60% for a free MOOC.
- Excellent post-course rating of 4.7 / 5

Foundations of Mine Closure and Sustainable Transition Mass Open Online Course






 406 people enrolled

 53% female attendance

 60% retention rate

 77% industry professionals, 9% postgraduate students, 7% given regulators/policy makers

 60% (246) from Australia  8% from Brazil 
7% from Canada  and 25% from 30 other countries

     *with a diversity of topics covered*

In focus: Supporting the next generation of leaders

- 20 PhD students investigating a diversity of topics.
- Focused on strengthening First Nations pathways – our goal is at least double the National benchmark.
- Overall target of 50 students over our life.

Our program encourages and supports partner placements, recognising the shared value.

Open to recommendations for placements:

- in regions.
- with regional or First Nations community organisations.
- with mining and METS companies.
- with governments.

Interview with Benedictor Kemanga

Working on future impacts of climate change on pit lake water balance, Ben's important research is supported by a CRC TIME top-up scholarship.



EDUCATION AND TRAINING PROFILE RESEARCH



POLICY, ENABLERS AND FRAMEWORKS



In focus: Enabling better transitions and diversification

Moving from site to regional scale

- **Developing knowledge, tools and resources to facilitate shift**
 - Enable regions to identify transition pathways, benchmark readiness, support engagement and undertake scenario planning ([Project 1.8](#)).
 - Regional cumulative effects assessment and management approaches to support positive transitions ([Project 4.7](#)).
- **Enabling collaborative planning and governance**
 - Understanding from First Nations communities what will enable them to negotiate and ensure mutual value.
 - Deliberative, consensus-building process in the Latrobe Valley to develop post-mining options – will provide national lessons.
 - Stage 2 includes an Indigenous Reference Panel, Citizens Jury and youth panel examining proposed options ([Project 1.7](#)).



In focus: Developing the evidence base

Informing decision-makers and connecting mine closure and regional policy

- **National principles:** Building the case for national principles on mine closure and post-mine transitions.
 - Consolidate knowledge across all dimensions, including considering post-mine land use and diversification.
 - Potential to frame future framework .
- **Guidance:** Comparative analysis of state/NT, national and global mine closure guidance ([Project 1.9](#)).
- **Relinquishment:** Developing policy roadmap, building off 2023 Queensland study.
- **Cooperative research:** Australian-first report by 13 CRCs mapping contribution to decarbonization.
 - Builds case and identifies changes required to further leverage this national infrastructure.
 - Western Australian Roundtable planned.



In focus: Facilitating connections that outlive us

- **Regions in transition**
 - Annual Forum: 130 people, Latrobe Valley in 2023
 - Coal regions: Collie, Latrobe Valley and Bowen Basin representatives in Mackay and Moranbah
 - Roundtables and local engagement
- **Fostering local networks**
 - Events/visits to Adelaide, Karratha, Darwin, Kununurra, Cairns, Morwell, south west WA, Brisbane
- **Bringing together communities of practice**
 - Education and Training Community of Practice
 - Twice-yearly College meetings
- **'Restoring Country' webinar series in development**
 - Facilitate dialogue and sharing to support Indigenous-led approaches



 THANK YOU

