Algae-based technologies for mine site rehabilitation and closure

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ABSTRACT

Mining is a key driver for Australia's economic prosperity and sustainable development, but it also poses long-term risks to people and the environment, even after mine closure. Land disturbance, atmospheric emissions, waste, and the generation of toxic mine drainage can threaten valuable land and water resources, as well as the sustainability of local communities. Integrating on-site algal culture or use of algal biomass into mining remediation scenarios offers notable benefits, combining waste management with ecological restoration and economic value generation. For example, algae can treat mine water, sequester CO_2, support dust suppression, improve mine waste stabilisation and facilitate ecological rehabilitation through its use as a fertiliser and biostimulant. Additionally, algal biomass can be used as a feedstock for producing various commodity products, such as bioplastics, biofuels, pigments, and animal feed. Overall, algal applications have the potential to accelerate ecological recovery and reduce the environmental impacts of mining. Moreover, algae-based technologies create business opportunities, turning post-mining land into economically productive ecosystems. This dual approach not only enhances rehabilitation outcomes but also ensures long-term sustainability for mining sites through the development of business opportunities for ongoing value generation beyond mine closure. Additionally, algae cultivation at mine sites may create jobs and offer new opportunities to engage Traditional Owners and other local communities. This presentation provides an overview of the findings of the Cooperative Research Centre for Transformations in Mining Economies (CRC TiME) project 3.15 which explores algae-based technologies for improved environmental outcomes and sustainable post-mining futures. The project is supported by CRC TiME via the Australian Government Department of Industry, Science and Resources through the Cooperative Research Centres Program; CSIRO, The University of Queensland, Murdoch University, South 32, Fortescue Metals Group, Rio Tinto, Heidelberg Materials, Mineral Research Institute of Western Australia, Queensland Mine Rehabilitation Commissioner, and Energy Australia.