Australia's Hydrogen Export in the form of Embedded Mineral Derivatives

G Burge[1] and R Daiyan[2]

1. Chemical Engineering Student, University of New South Wales, 2033. gabi.burge@outlook.com:
2. Scientia Senior Lecturer at the School of Minerals and Energy Resources Engineering, University of New South Wales, 2033. r.daiyan@unsw.edu.au:

Keywords: Green minerals, Copper, Decarbonisation, Techno economic modelling

ABSTRACT

Demand for green minerals is increasing, and the Australian mining sector is facing pressure to reduce emissions or risk a decline in export value. Exporting renewable hydrogen in the form of embedded mineral derivatives is an opportunity to both decarbonise the minerals sector and secure a pathway for Australian hydrogen to enter the global market.

The Copper Value Chain Assessment Tool, a techno-economic model of the copper value chain, was developed and used to analyse a case study of copper production in Queensland. The case study found that currently, green copper produced with hydrogen at \$8 /kg-H_2 has a levelised cost of \$9,704 /t. Compared to a fossil fuel derived product which costs \$8,912 /t, green copper is not currently competitive. Sensitivity analysis of the cost inputs of copper found that hydrogen price is a significant driver of the high cost of green copper.

To understand the impacts of hydrogen price, economic analysis of several scenarios of electricity, hydrogen and carbon credit prices predicted for 2030 was undertaken. It was found that when produced with hydrogen supplied at \$2 /kg-H2, the levelised cost of green copper is equal to the fossil fuel product. And in a moderate to high carbon pricing environment (\$54-79 /kg-CO2), \$3 /kg-H_2 is sufficient for green copper to be economically viable. Therefore, it was demonstrated that the pathway for exporting renewable hydrogen in the form of embedded mineral derivatives must have a strong focus on decreasing hydrogen production costs.

There has been industry interest in the developing the tool further and expanding it to accommodate other mineral derivate value chains. The outcome of this work would be an open-source tool that will allow stakeholders and other researchers to evaluate pathways for critical minerals and direct investment to the most impactful areas of the mineral value chain.