

Exploring Circular Economy and Decarbonisation Barriers in Australia's Lithium and Rare Earth Elements' Industry

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ABSTRACT

The global shift towards achieving a Net-Zero economy is gaining momentum, encompassing a broad spectrum of initiatives ranging from renewable energy technologies, electric vehicles (EVs), to battery energy storage systems. Benefiting from its significant reserves of lithium (Li), a critical component, along with an array of other rare earth elements (REE), Australia is at forefront to lead the change towards clean energy solutions and environmental sustainability. Beyond powering renewable technologies, these minerals play a pivotal role in high-tech industries for manufacturing of a wide range of electronic devices for example cell phones, tablets, lighter flints, fluorescent lamps, lasers and super magnets etc., showcasing their versatility and importance in modern society. Specifically, Australia's reputation as a Li powerhouse is underscored by its abundant spodumene reserves, recognised as the world's largest deposits of this critical mineral. Additionally, the nation contributed more than 5 % of total REE's production of world. However, the extraction, processing, and disposal of these resources can pose complex environmental, social, and governance challenges that demand innovative solutions.

In such a context, herein, we will critically examine the intersection of Australia's lithium and REEs sectors with circular economy principles, focusing on technological advancements in mineral processing, environmental considerations, recycling, and waste utilisation strategies to achieve sustainable resource management. Aligning to the circular economy principles, the proposed strategies for the establishment of recycling systems for lithium-ion batteries and electronic waste, and the exploration of innovative approaches for waste utilisation and valorisation will also be discussed. Using Li as a case study, a comprehensive framework will be presented to illustrate the value addition to the supply chain. This study aims to foster industry partnerships and engage stakeholders in promoting circularity and enhancing the sustainability of Australia's lithium and REEs sectors. Through interdisciplinary collaboration and proactive measures, the nation can harness its resource potential while minimising environmental impact, promoting social responsibility, and contributing to global sustainability efforts.