Minerals such as lithium, indium and rare earth elements (REEs) like dysprosium and neodymium are vital for technologies that will help cut greenhouse emissions and decarbonise our economies. Many of these minerals are ¹. The move to a low-carbon energy

system requires a significant increase in mineral resources - in both absolute quantities of material and the relative proportion required by low-carbon development².

Deep seabed mining (DSM) is proposed as a method for meeting the increased demands for some of the minerals needed for the energy transition, although it is not clear whether it is necessary to use DSM do so. Some forecasts suggest that demand for critical minerals can be met from terrestrial sources³. Increased recovery and recycling of critical minerals from end of life products, and resource efficiency, as part of a circular economy will also help to reduce the need for primary extraction. In addition, many of the minerals that can be obtained from DSM are not currently classed as critical³.

Although the impact of DSM is likely to be significant^{4,5}, it is not well-understood at present, neither in terms of its timescale nor in terms of its extent, due to this uncertainty, some experts propose a cautious and comprehensive approach to decision making^{4,5,6,7}. While a lot of progress has been made towards understanding the chemical Senvironment in the deep ocean, multiple knowledge gaps exist at the moment regarding the impacts of deep seabed mining on the seafloor. These include gaps in knowledge around the impact on biogeochemistry, ocean carbon sequestration and climate regulation, nutrient cycles, biodiversity, ecosystem services, and understanding the environmental baseline and ways to mitigate any impacts. The impacts on adjacent environments and systems (e.g. climate, geographic, societal) should also be considered

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While critical minerals are essential to the low-carbon energy transition and to many other sectors of the economy (including healthcare, security and consumer electronics), it is vital that the environmental and social risks of increased mineral demand are managed carefully while also safeguarding supply chains. It is therefore important to move away from only considering primary extraction on its own to considering the whole materials economy, including resource efficiency and recycling. This will require long-term, coherent policies and coordination and alliances with global partners.

Moving from a linear take-make-waste economy to a circular economy for critical minerals will reduce reliance on potentially uncertain sources of critical minerals. These approaches also help to cut waste and reduce embodied energy of second-life products while also reducing the energy requirements and environmental impacts associated with mining and refining of primary materials, by orders of magnitude in many cases⁸. Enabling policies will be

this statement drawing on evidence from chemical scientists and other experts working on these issues, and we are grateful to all the individuals who provided their expert input into its development and scientific review.

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UK Department for Business, Energy and Industrial Strategy,