

SUBMISSION

Submission to the Department of Industry, Science and Resources

Submission to Updating Australia's Critical Minerals List

17 August 2023

The Australian Academy of Technological Sciences and Engineering (ATSE) is a Learned Academy of independent, non-political experts helping Australians understand and use technology to solve complex problems. Bringing together Australia's leading thinkers in applied science, technology and engineering, ATSE provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

Australia's [Critical Minerals List](#) signals our in-demand minerals to industry and international trading partners. Chiefly, these minerals are enablers for the technologies that underpin the Australian economy and way of life. Updating the Critical Minerals List is an important next step for the Critical Minerals Strategy, released in June 2023. ATSE [welcomed the release](#) of the Strategy, including its focus on developing a skilled workforce and embedding workplace inclusion, in alignment with ATSE's [submission](#) to the Strategy. The 2023 update to the Critical Minerals List provides an opportunity to recognise elements of increasing importance for decarbonising the economy, and to align with global as well as domestic aspirations. ATSE makes the following recommendations for the update to the Critical Minerals List:

Recommendation 1: Add tin, copper and nickel to the Critical Minerals List due to their role in the energy transition.

Recommendation 2: Include recycling in assessment of Australia's resources of critical minerals.

Recommendation 3: Assess new additions to the Critical Minerals List for their alignment with reaching the United Nations' Sustainable Development Goals.

Recommendation 4: Monitor potassium, zinc, uranium and thorium for future inclusion in the Critical Minerals List.

Modernising the Critical Minerals List for decarbonisation

Since the last update to the Critical Minerals List in March 2022, the Australian Government has put forth an ambitious decarbonisation agenda through the *Powering Australia* plan, which includes an electric vehicle strategy and upgrading transmission networks. These new developments necessitate reviewing the Critical Minerals List for the commodities that will be crucial for the renewable energy transition.

ATSE recommends that tin, copper and nickel are added to the Critical Minerals List to support the push to net zero. All three meet the criteria for inclusion in the list, being essential to modern technologies and the economy, vulnerable to supply chain disruption, needed by our trading partners, and with potential for mining in Australia. Australia has capacity to increase production for these globally in-demand elements while adhering to high environmental, social, and corporate governance (ESG) standards. Regardless of Australia's activity in mining and exporting these metals, they will be required domestically to support the energy transition.

Tin

Tin is used ubiquitously for soldering electrical components and circuit boards in consumer and industrial electronics. It also has applications for solar panel manufacturing, batteries (including for electric vehicles), and semiconductors. This is alongside older applications such as tin-coated steel cans for food storage. While tin usage in electronics declined due to technological advancements in miniaturisation, it is anticipated that there will be no further reductions in the foreseeable future, and demand for tin will track with increased production of electronics, especially as lead soldering phases out (Home 2020b).

Tin will become increasingly important for the renewable energy transition and advanced computation and connectivity. Circuit boards are becoming more prevalent due to the internet of things (physical devices with sensors, processing power and internet connectivity). More circuit boards will also be required to support increased processing power for artificial intelligence, and to enable utilisation of 5G and cloud computing. Electric vehicles also require tin for their batteries and circuitry.

Australia is the world's eighth largest producer of tin, with capacity to increase tin production and export (Geoscience Australia 2021). Australia has significant deposits of tin in Tasmania and smaller deposits in Queensland and Western Australia, as well as tailings dams containing tin that could be recovered. Global tin production has also been vulnerable, facing disruption during Covid-19 lockdowns (Home 2020a). More recently, tin mining has been suspended in Myanmar, one of the world's main tin exporters (Donaldson 2023).

The significance of tin has been recently recognised by its addition to the New South Wales Critical Minerals and High-Tech Metals Priority List (NSW Government 2022). Tin also appears on the current edition of the United States Final List of Critical Minerals (U.S. Geological Survey 2022). Adding tin to the Critical Minerals List would signal support for the new technologies required to extract it.

Copper

Copper is key for electrification, being used for electricity transmission, household and industrial cabling as well as for wiring and batteries in electric vehicles. Copper also has widespread applications in water pipes and heating and cooling systems.

Like tin, copper will become more important for the transition to renewable energy. However, global demand is projected to soon exceed supply. Mining companies and industry groups have stated that an increase in copper production will be required for the energy transition and to meet the Paris climate agreement (Scheyder 2023).

Australia is the world's sixth largest copper producer, responsible for 4% of global production, yet holding 11% of the world's copper resources spread throughout Australia (Geoscience Australia 2021). Australia has an opportunity to increase copper mining to meet demand for domestic use and exporting. The potential for Australia's copper production to increase is being explored by the [Copper for Tomorrow CRC](#), which focuses on supporting the copper supply chain and embedding sustainability into production and processing.

Copper is regarded as an energy transition metal by the Critical Mineral Strategy but is not currently listed as a critical mineral. Copper appears on the critical minerals lists of New South Wales and the Northern Territory, and is regarded as critical by Queensland's Critical Minerals Strategy (NSW Government 2022; NT Government 2023; Queensland Government 2023).

Nickel

High purity nickel is in demand for batteries, including rechargeable batteries and in electric vehicles. Nickel also has extensive applications in alloys, coins, and electroplating. There are technological challenges for nickel production, with new processes in development. Nickel is relatively abundant, but demand will increase with the energy transition.

Australia is the world's fifth largest nickel producer globally and has the most nickel reserves (Geoscience Australia 2021). There are significant nickel deposits in Western Australia and Queensland, though mining activity has fluctuated with the price of nickel.

Nickel has been identified as a critical mineral by many international competitors, including the United States (where it also appears on the subset of the list for 'critical minerals for energy') and Canada. (U.S. Geological Survey 2022; Government of Canada 2022). The United Kingdom has placed nickel on its critical minerals watchlist (i.e., it may become a critical mineral) due to its importance for electric vehicles and supply chain disruptions with the Russian invasion of Ukraine (U.K. Government 2023).

Domestically, it appears on the New South Wales and the Northern Territory's critical minerals lists (NSW Government 2022; NT Government 2023). The Western Australian Government has also identified nickel as a critical mineral for electric vehicles, renewable energy, and energy storage (Government of Western Australia 2022). Nickel is identified as an energy transition metal in the Critical Minerals Strategy.

Recommendation 1: Add tin, copper and nickel to the Critical Minerals List due to their role in the energy transition.

Highlighting the circular economy as a resource

ATSE agrees the current set of criteria provides a practical method to identify important yet vulnerable commodities. The fourth criterion, that there must be potential domestic geological resources of the mineral, could be modified to include the circular economy as a resource. Reclaiming and recycling could be a significant source for production for some critical minerals, as a source of secondary metal production

alleviating pressure on primary sources. This could include extraction from waste products from mining other minerals – an area of active technological development. Mining and processing waste can contain high concentrations of elements, that has not been extracted where this has not been economical in the past. As supply and demand changes, and as new technologies develop, this may become a more attractive economic proposition.

Recommendation 2: Include recycling in assessment of Australia’s resources of critical minerals.

Aligning critical mineral criteria with Sustainable Development Goals

In addition to the four criteria for inclusion in the Critical Minerals List, ATSE recommends screening potential additions to the list for their alignment with achieving the United Nations’ Sustainable Development Goals (SDGs), as a useful supplementary framework. Availability of critical minerals, including those recommended in this submission for addition to the Critical Minerals List, will underpin progress for many of the SDGs. Relevant SDGs include affordable clean energy (SDG 7,) economic growth (SDG 8), resilient infrastructure and sustainable industrialisation (SDG 9), and responsible consumption and production patterns (SDG 12). Using SDGs alignment as an additional lens will allow identification of other minerals of importance.

For example, potassium (mined as potash) will be important in ending world hunger (SDG 2) due to its application in fertiliser. Potash appeared on an older version of the United States’ critical minerals list. The United States Environmental Protection Agency considers there is a low risk of supply disruption, but heavy agricultural usage creates a vulnerability to any supply disruptions (Environmental Protection Agency 2022). Its status may be considered similarly to alumina, which appears in the list but is not currently vulnerable to supply chain disruption. Australia’s potash production is in its infancy, with the first mine opening in 2021 (Ker 2021). While potash or potassium do not currently meet all four criteria for addition to the Critical Minerals List, it should be monitored for possible future addition.

Zinc is another potentially critical mineral that should be monitored. Zinc is primarily used for galvanising steel and is therefore important for high density housing construction and transport infrastructure (Minerals Council of Australia 2022). This aligns with the goal of making sustainable cities and communities (SDG 11) Zinc is a new addition to the United States’ critical minerals list (U.S. Geological Survey 2022). Zinc also features on the New South Wales list, noting the potential for recovery from mining waste (NSW Government 2022).

Uranium and thorium should also be considered for future iterations of the list. Australia exports uranium used by other nations in nuclear power generation. Uranium also has domestic applications for nuclear medicine and naval vessels (Minerals Council of Australia 2022). While it is not currently vulnerable to supply chain disruption, this should be monitored for any changes. Thorium may also become more important in the future with development of thorium-based nuclear reactors. Australia has vast deposits of thorium, with no current mining activity (Geoscience Australia 2021). Due to its healthcare applications, uranium contributes to the goal of ensuring health and well-being (SDG 3). Both uranium and thorium can be utilised in other nations’ efforts to supply affordable and clean energy (SDG 7).

Recommendation 3: Assess new additions to the Critical Minerals List for their alignment with reaching the United Nations’ Sustainable Development Goals.

Recommendation 4: Monitor potassium, zinc, uranium and thorium for future inclusion in the Critical Minerals List.

ATSE thanks the Department of Industry, Science and Resources for the opportunity to respond to the consultation on Updating Australia’s Critical Minerals List. For further information, please contact academypolicyteam@atse.org.au.

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