Phosphorous Policy Brief

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Summary

- Australia is highly dependent on a narrow range of importers for its' supply of phosphates, a critical input into Australian agriculture.
- 80% of global phosphate exports come from 4 countries: Saudi Arabia, China, Morocco, and Russia.
- There are real risks of phosphorus supply shocks. The Australian government should consider mechanisms for managing supply shocks, including establishing a stockpiling program for phosphates.

Introduction

Critical and strategic minerals and materials are an extremely diverse group of resources with a wide variety of applications, market sizes and structures, and key risks. As Australia now has 36 officially designated critical and strategic minerals, ranging from copper to scandium, there are few recommendations or analyses that apply cleanly to the entire space. Given their variety, governments have a range of rationales for declaring minerals as critical, as well as many different policy instruments and responses. The East Asian Bureau of Economic Research has conducted a scenario analysis of phosphorous, a mineral listed as critical or strategic in Australia, New Zealand, the European Union, and a number of other countries.

Phosphorous: An Overview

Phosphorous, mined as phosphate rock, is a mineral used in the production of fertiliser. Commodity fertilisers are worth around US$150 billion a year and are an essential input into agricultural production, as they provide soils with their key nutrients: phosphate, nitrogen, and potassium.

As agriculture is a globalised industry, phosphate demand is similarly globalised. China, India, and Brazil are the three largest consumers in part because their phosphate intensity - the amount of phosphate utilised per acre of farmed land - is extremely high. The United States is the fourth largest consumer, but with significantly lower phosphate intensity, while Australia is the ninth largest.

Supply is far more concentrated. Of the export market, which Australia relies on, four countries are dominant: China, Morocco, Saudi Arabia, and Russia. Russia is not a significant supplier to Australia, due to being able to better access markets in the Atlantic region. In addition, China has sought to curtail exports, citing the need to control domestic prices.

Phosphorous as a Critical Mineral

Phosphorous' status as an essential input for agriculture and its narrow supply base are of significant concern. While the market is much larger than many critical minerals, the high level of export concentration makes phosphorous particularly vulnerable to supply shocks. Its importance as an input in food production means that fertiliser supply shocks have major ramifications for both local agricultural economies (input costs can reduce farm margins if product prices don't rise enough to compensate) and global food security.

There have been two major shocks to global phosphate production in recent years. Firstly, China, the world's largest phosphorous producer, imposed export quotas in 2021. These export quotas were imposed for the purpose of controlling domestic prices and ensuring security of local supply. Importantly, they do not appear to have been targeted at a particular country or linked to any international dispute or disagreement. In this regard, they are distinct from other, more recent Chinese controls on exported mineral products (for instance, on rare earth elements). Nonetheless, these controls have caused a permanent, structural reduction in China's export volumes. The second factor is that Russia's invasion of Ukraine caused significant disruption to global phosphate supplies. While Russian phosphates and fertilisers have not been subject to large-scale formal sanctioning in the way that energy exports have been, self-sanctioning has restructured supply chains.

Phosphate also has emerging demand from the battery sector, due to its use in cathode material with lithium and iron. This has led some to become concerned that the international phosphate production system will be unable to support growing total demand. In practice, the issue is the ability of phosphoric acid plants to produce high-enough quality acid to be used in battery use cases. Regular phosphoric acid requires less-demanding standards than battery phosphoric acid, and it is estimated that only 3% of global phosphoric acid supply can meet demand. This is not an issue of the underlying resource, as much as it is a limitation of current processing, but there may be additional demand-side pressures on existing phosphorus sources in the future.

Phosphorous in Australia

Australia's demand for phosphorous imports has risen primarily because of domestic factors. Firstly, fertiliser usage is an important input into a productive, efficient agricultural sector, and fertiliser usage expands along with cropland utilisation. Importantly, phosphorous is not substitutable as a soil input; all agricultural soil needs a balance of nitrogen, potassium, and phosphate. Secondly, local production of fertilisers has been falling, due to a combination of higher energy costs and shifting product preferences. Local fertiliser plants tend to be smaller and older, making them less competitive on a unit cost basis and at times unable to supply the products preferred by Australian farmers. Energy costs have also contributed to making onshore fertiliser production less competitive.

Australian agricultural production is both locally and internationally significant. Locally, Australian agriculture output directly affects consumer prices. In addition, for regional and rural communities, strong margins can have high multiplier effects, due to the importance of agriculture for local economies. Australian food exports also play an essential role in regional food security. Two major agricultural export commodities, wheat and barley, are inherently dependent on fertilisers.

While there are several phosphate mines either operating or under development in Australia (including Christmas Island), they are designed to export phosphates abroad, rather than produce local fertiliser. Phosphate production sites tend to be isolated from major demand centres, as well as fuel and electricity sources. The exception is Phosphate Hill in Mount Isa, where phosphate production is integrated with a fertiliser facility, but this site has been scheduled for closure in September 2026 unless a buyer can be found.

Other fertiliser production sites in Australia are either dependent on imported inputs or are being steadily closed and converted to fertiliser import-only facilities.

It's important to note that the Australian phosphorous is highly bifurcated between eastern states (NSW, Queensland, Tasmania, and Victoria) and the remainder (SA, WA, and the NT), with different sourcing patterns across the two markets.

Australian Policy Drivers

There are a range of policy drivers as to why Australian governments might wish to support phosphate within Australia. These include:

- Industry development — phosphate production can be processed and upgraded into fertilisers through onshore manufacturing. The policy aim would be to increase economic activity and employment in the phosphate and fertiliser industries and associated sectors.

- Regional and workforce development — Australian phosphate prospects are often highly isolated and located in regional locations. Providing support might sustain or build workforce and regional economies in areas where there are limited alternatives for a time-limited period until the operations become globally competitive. Phosphate or fertiliser production would also represent a diversification from primary commodities, expanding the workforce's skill base.
- Export opportunities — phosphate projects in Australia have typically been oriented towards exports. Given the reduction in exports from China, there has been an increase in out-of-region sourcing in Asian phosphate markets. Providing financial and other supports might bridge the gap between current prices and future prices such that domestic refinement capacity can eventually compete in global markets without government support.
- Strategic resiliency — given Australia's significant import and consumption requirements for phosphates and risks to imports, government intervention might buffer against global supply shocks, ensuring continuity of supply to regional customers.

Data Insights

The East Asian Bureau of Economic Research modelled a supply-side shock based on the export controls imposed by China in 2021. Chinese fertiliser exports totalled 10 million tonnes in 2021, their peak, before falling to 6.4 million tonnes as of 2024, the baseline year to which shocks are applied. Our analysis found that there are likely to be material and sufficiently prolonged shocks from reduced global supply that warrant consideration of Australian government intervention to ensure continuity of phosphorus supply. Our models are flexible as to the degree of export controls imposed and the concomitant reduction in exports.

Supply-side shocks are problematic under two conditions. Firstly, the shock must be of sufficient scale to have an impact on global traded fertiliser balances. While Chinese phosphate exports are significantly lower than pre-2021, they remain an important supplier for the Asia-Pacific region. Secondly, the shock must be sufficiently prolonged to affect seasonal crop plantings. In the Australian context, phosphate importers and distributors build up stocks between major planting seasons. These stocks are then distributed to farms in preparation for plantings. A supply shock becomes a risk to agricultural output if it prevents the accumulation of the stocks necessary for a planting campaign.

The costs of a supply shock come from both increases in the price of phosphate products, as well as increases in switching costs. Reducing or removing a large supplier, *ceteris parabis*, increases the price for all other consumers. Switching costs, by contrast, refer to the additional costs imposed to change to a new supplier. For phosphates, these are higher shipping costs, with alternative suppliers like Morocco and Saudi Arabia being ~25% further away than China.

Policy Recommendations

There are several options for a government seeking to enhance local supply security, but the most obvious and straightforward is stockpiling. Our models show that a baseline stockpile of 500,000-700,000 tonnes of locally held phosphate would deliver significant benefits to

Australia to ameliorate the risk of crop failures from lack of access to phosphate. The goal for the stockpile is to “smooth out” the adjustment period in the event of a supply-side shock.

While it is obviously impractical to fully replace foreign supply over an extended period, a stockpile would ease the adjustment costs on importers as they seek new suppliers. This stockpile could either take the form of increased stockholding requirements imposed on major phosphate importers, or through a government-managed reserve scheme. Further work is required to ascertain the optimal model of stockpiling, including how to share the costs (estimated at between $350m and $500m of stock plus annual storage costs) between industry and public funding.

With regards to local fertiliser production, there are strong reasons not to provide specific support for the sector. The single most important issue facing the sector, increased energy costs, is best addressed through broader energy policy, rather than through sector-specific measures.