*Australia is pivoting its economy away from dependence on resources like coal and iron ore, but are there other commodities we can bank on to take up some of the slack? In this “future commodities” series we explore the economic future for commodities we've always relied on, and some we haven't.*

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Australia can capitalise on graphite if it considers new technologies that convert it to synthetic diamonds and for use in creating carbon fibres, rather than just mining the mineral.

Graphite is a form of carbon, the same element which also appears in nature as coal or diamonds, depending on the geological roots of its formation. At present high quality graphite is used in a range of technology from refractories to lithium ion batteries to carbon composites that constitute modern cars and aircraft such as the 787 Dreamliner or the Airbus A350.

Global demand for graphite was estimated by the U.S. Geological Survey to be around 1250 kilotons in 2014 but could triple by 2035., with the largest growth occurring in its heavy use in lithium ion batteries. Tesla motors massive investment in this technology for domestic home energy storage may provide a major boost to the market. The "gigafactory" being built by Tesla in the US state of Nevada is expected to raise global graphite demand by 30%.

Australian companies have been proactive in anticipating graphite demand growth and there are now several ASX-listed mining firms with graphite ambitions. The New South Wales government has even noted graphite in its prospectus document on industrial mineral opportunities.. At present there is only one functional graphite mine in Australia, the Uley graphite mine on the Eyre peninsula run by Valence Industries. At least 8 other ASX listed companies are known to be exploring for graphite.

The supply of graphite from mined sources is not well-understood due to lack of exploration and geo-science investment in this arena. However, a more integrative approach that considers synthetic sources as well as mining is needed to harness the full potential of graphite.

More than seven decades ago, scientists at General Electric devised a process to convert graphite to industrial quality diamonds using very high pressures and temperatures. These diamonds were not of the quality for an engagement ring but worked very well on the edge of cutting saws as “superabrasives.” Stanford researchers have since been working on even easier means of converting graphite to diamonds through catalysts. Most diamonds used now in industry are synthetic.

Although these diamonds are unlikely to be in demand in the jewellery retail sector any time soon, their prominence could grow for industrial uses. A subsidiary company of international diamond miner De Beers, called Element 6, has been working on a range of high technology uses of industrial diamonds, such as infra red sensors and radiation detectors. This will spark more interest from businesses in this sector.

However, there is potential to convert coal to graphite and its related nanotechnology material “graphene,” for use in greener energy technologies. The technology to accomplish this exists but needs to be made far more cost effective and energy-efficient. Graphene use, like diamonds, by volume will be small as well, though of high importance in terms of its use in strategically important technologies. The large volume uses of graphite would come from demand growth for large structural uses in batteries, buildings and vessels.

There is another type of graphite, high grade vein, that is relatively rare. Currently, the only functional mine for vein graphite is in Sri Lanka which boasts some of the world’s largest reserves of this particularly high grade material. China remains the dominant player in other forms of graphite mining because of public sector investment in its geological reserves, but increasingly is willing to partner internationally on mineral projects, exemplified by efforts such as Rio Tinto’s Mines to Markets partnership.

Finding better ways of converting coal to graphite for making carbon fibres and other products, could also lead to innovations that make the material more recyclable as well. This goes towards realising the goals of what the World Economic Forum has called “A Circular

Economy.” This is when materials cycle back through the production and manufacturing processes. Metals that are traditionally used in large structures corrode over time, whereas carbon fibres have much less propensity for such corrosion and hence have a life cycle more conducive to recycling .

Graphite presents an important opportunity for seeing the value of partnering business and science to remain “ahead of the curve” in sourcing essential materials for the future. As the bad press increases for the burning of coal for fuel, its value could be in conversion to other forms of carbon – like graphite.

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