The Power of 3
Driving the future further
ISSUE 32
November 2019

Critical raw materials – a political hot potato

[Source: Common Dreams.]

Overview

On a recent visit to America, Australian Prime Minister Scott Morrison, in discussions with President Trump, refered to "political raw materials" rather than "critical raw materials," the latter the generally accepted term for resources crucial to advanced technologies. So, did he mean to say it (it does make sense!) or was it merely a Freudian slip?

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This week, 11,000 scientists declared "clearly and unequivocally [that] planet Earth is facing a climate emergency." Whether or not a crisis looms, the planet should not be treated with cavalier disregard. Humankind needs to control population growth, halt forest destruction, counter pollution and foster 'green' economies – leaving fossil fuels in the ground, transitioning to low-carbon energy production, adopting renewables and clean mobility, and enhancing communication.

For quality of life, technological progress is essential, and that relies upon the ready availability of non-energy raw materials closely linked to clean technologies, materials that are irreplaceable in things like solar panels, wind turbines, electric vehicles and energy-efficient lighting.

New materials to meet the challenges of now and beyond may incorporate metals, non-metals and mineral elements the total world reserves of which (in primary deposits) are limited in quantity and unevenly distributed. In addition, their exploitation can involve significant effort in terms of investment and exploration, with attempts to extract and process them accompanied by a high environmental burden and negative social impacts. Unlike with fossil fuels, however, it *is* possible to recycle such materials and thus retain them as resources, though attempts to 'close the materials loop' (particularly with certain specialty metals) may be hampered by physical and economic challenges.

Hence the term 'critical raw materials'.

Strategic importance of critical raw materials

Both the European Union (EU) and the United States (US) have developed and regularly update their list of critical raw materials (CRMs), which are classified as 'critical' not due to their scarcity but because of:

- their **significant economic importance for key sectors of the economy**, including consumer electronics, environmental technologies and the automotive, aerospace, defence, health and steel industries;
- their **supply risk** in terms of creating a dependence on imports and the fact that some are found in their highest concentrations in particular countries, and
- a **lack of** (viable) **substitutes**, owing to the unique and reliable properties of such materials for current and future applications.

As EU and US trade agreements and long-standing partnerships differ, so do the materials on their CRM lists. A glaring example of this is lithium, considered 'critical' by the US (which produces only a small amount) but not by the EU, despite the crucial importance of this element in efforts to transition to a low-carbon economy.

Why is lithium not considered 'critical' to the EU? Because at present, no industries there actually need it. Although several European battery plants are in the pipeline, none are yet up and running, so supply is not an issue. Presumably, though, this is about to change – and fast.

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Defining CRMs

The latest (2017) CRMs listed by the EU are considered economically and strategically important for the entire European economy but extremely high-risk in terms of supply. They include antimony, beryllium, borates, cobalt, coking coal, fluorspar, gallium, germanium, indium, magnesium, natural graphite, niobium, phosphate rock, silicon metal, tungsten, platinum group metals, light rare earths and heavy rare earths, barite, bismuth, hafnium, helium, natural rubber, phosphorus, scandium, tantalum and vanadium.

Meanwhile, the US defines its CRMs as those crucial to national security and the economy but for which secure access is not assured. One of the selection criteria for so defining them is that more than 50% of domestic consumption is met by imports. As of May 2018, the US list comprised aluminium, antimony, arsenic, barite, beryllium, bismuth, caesium, chromium, cobalt, fluorspar, gallium, germanium, graphite (natural), hafnium, helium, indium, lithium, magnesium, manganese, niobium, platinum group metals, potash, rare earth elements group, rhenium, rubidium, scandium, strontium, tantalum, tellurium, tin, titanium, tungsten, uranium, vanadium and zirconium.

CRMs are **essential** for transitioning to low-carbon energy. What, then, are major and emerging economies doing in this respect?

- **India** is developing a CRM strategy through to 2030.
- **Indonesia** is doing a stocktake of its CRM inventory (being potentially self-sufficient in tin, tungsten, lithium and rare earth elements (REE)).
- **Europe** has recognised the importance of recycling materials it views as vital to creating a circular economy.
- **Japan** supports the recycling of nickel and cobalt (important components of lithium-ion batteries).
- **America** will not place tariffs on critical materials imported from China (more than 80% of the REE group used in America are imported from China, so the president must tread lightly if he's to keep his forces armed!).

Sourcing CRMs

Right now China dominates the processing of lithium and REE (which are not actually that rare). All are crucial to electronics – including strategic defence applications – and the implications of sudden supply-chain disruption could be quantified like this: more than 3000 types of military hardware would not function without them (imagine troops without night-vision goggles, strike fighters without navigation systems and missiles without guidance), hospitals could not offer magnetic resonance imaging, and a life minus computers, tablets, mobile phones and flat-screen TVs would be unimaginable for many!

*Rare earth elements – the 'vitamins of chemistry'– produce powerful effects in small doses. [Source: **The Verge**.]*

Together, the CRMs listed by the EU and the US make up much of the periodic table. Currently, Australia has the resources and the potential to become globally competitive in this domain. And, while it lacks an effective CRM policy at present, Australia could leaven the 'critical' in CRMs by implementing supply-chain control beyond primary extraction of the materials themselves. The Critical Minerals Strategy released this year cites the key challenges for Australian operators hoping to become more competitive in global CRM markets as:

- lowering the costs of mineral extraction, and
- reducing the impact of such activities on the environment.

Australia should aim not only to supply the CRMs vital for a cleaner planet but also to implement supply-chain reforms before the major economic powers implement their policies in that regard. And, while supplying CRMs is a great financial opportunity for Australia, it shouldn't end there. Environmental responsibility dictates the implement-ation of ethical, sustainable methods for extending the lifecycle of CRMs (finite assets)through recycling. Australia must grab the bull by the horns, not just creating a viable CRM policy but also adopting world's best practice to maximise sustainability.

Australia really can take ownership of the term 'political raw materials' ... if it picks its trading partners well.

And finally ...

In space, as on Earth, energy-dense, long-lasting, rechargeable lithium-ion batteries have become the power pack of choice. Last month, NASA undertook the last in a series of space walks (begun in 2017) to upgrade batteries on the external truss structure of the orbiting science lab known as the International Space Station (ISS). The mission was a success, with the last two nickel-hydrogen batteries manually swapped for one new lithium-ion battery. And for those not in the know, lithium-ion batteries also power the ISS spacesuits. Even in orbit, it pays to be clean and green!

The business plan of which Perth-based company is predicated on creating a circular economy by refining mine waste and recycling CRMs?

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