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Victoria Pullen
Branch Head
Critical Minerals Office
GPO Box 2013
Canberra ACT 2601

By email: Victoria.pullen@industry.gov.au

Dear Victoria

Thank you for the opportunity to provide a submission on Australia's Critical Minerals list.

In forming its response the MCA has considered the supply chain, extending from exploration, mining, processing, manufacturing to technology assembly, and the importance of supply security if any link in these chains faces shortage or disruption.

Fundamentally, Australia's approach and formulation of its critical minerals list must change. Australia must highlight what it can produce and the security of supply it can underwrite. It must invite participation, through investment, partnership and co-operation in the same way that Canada's critical minerals list frames security of supply and supply chain participation.

The global subsidisation race has accelerated. Governments are looking to secure the supply of assembled technologies by onshoring as much of their supply chains as possible, and 'friend-shoring' those parts they cannot onshore. For Australia, our strength is our minerals and minerals processing.

It is important to recognise that no country can become entirely self-sufficient across the spectrum of materials and manufactures or along the entirety of the supply chain for complex technologies.

Each country will have a different profile along each of its supply chains in terms of where its competitive advantage sits and where its supply chain exposures are. Governments globally are participating in a subsidy fuelled race to onshore as much of their supply chain vulnerability as they can. However, all countries will need to rely on others for end-to-end supply security. That raises the need for investing in cementing important relationships and supply chains for energy, defence and other strategic industries, trade diversification and deeper economic ties with security partners.

Australia remains an important part of global supply chains for future facing technologies and the security of the supply chains providing the inputs to those technologies.

It has the resources, the skills, technical ability and community support to extract and process raw minerals – in many cases transforming them into strategic materials. Australia also has the potential to move further along the supply chain into manufacturing. Australia's capacity to grow its role in global supply chains remains dependent on its domestic policy settings – its ability to kick-start productivity growth and its ability to signal stability, reliability and sustainability – the global supplier of choice.

However, Australia's vulnerability also remains its access to the manufactured and assembled technologies that it needs to deploy for its own economic opportunities, performance and net zero transition.

Just as the governments of manufacturing economies look to secure supply chains for the critical minerals and strategic materials they need, Australia must look to partner with governments to manufacture and deploy the needed assembled technologies. The dialogue within the partnerships and strategic alliances must be guided by a focussed analysis of the supply potential and demand needs along each economy's supply chains and how best to jointly or collectively secure them from extraction to technology deployment.

A critical minerals list is an important tool for governments. It focuses attention on supply risk and supply potential in different parts of the supply chain. Importantly, it also provides a focus for co-operation, co-investment and supply chain security partnerships.

For many other countries, the critical minerals lists are an indication of what their economies need to source. For Australia, the critical minerals list provides an opportunity to highlight the minerals, materials and manufactures Australia has the potential to supply and where the opportunity lies to become the secure supplier of choice to our strategic and trading partners.

Recognising Australia's existing advantages, and the needs of our strategic partners, the MCA recommends the inclusion of the following in Australia's list of critical minerals at **Attachment A**.

To capitalise on this opportunity, governments must also establish the economic policy settings that drive productivity. This includes designing and implementing industry policy settings that drive economic and regulatory efficiency and pull forward investment along value chains – from exploration and mining, through processing and to the extent possible, manufacturing and assembly industry.

The Australian government has a unique opportunity to re-capture Australia's potential as a reliable safe and secure supplier of choice.

These themes underpin the responses to the consultation questions below.

Yours sincerely

DEMUS KING
GENERAL MANAGER
TRADE AND INVESTMENT

1. **Is the current set of criteria still fit for purpose? The Critical Minerals List currently includes minerals:**
   - **essential to modern technologies, economies and national security**
   - **whose supply chains are vulnerable to disruption**
   - **that our strategic partners need**
   - **for which Australia has potential economic geological resources.**

   The criteria for the current critical minerals list, as described above, are still broadly relevant to an assessment of a minerals criticality.

   However, the government could clarify the intent of the Australian critical minerals list (ie is the list focussed on what Australia can offer to manage the supply security of other nations, or is it a list of critical material inputs that may pose a vulnerability to Australia via the technologies that it needs for its own future infrastructure.

   Clarity of purpose would sharpen the formulation of the list and its use internationally, domestically and with our strategic partners.

   To this end the government could develop an Australian critical minerals and strategic materials list that responds to the list of each strategic partner and informs dialogue on two-way security:

   a. Along the physical supply chain: raw, processed, component manufacture, technology assembly, technology deployment, and
   b. Into the supply chain for capital, technology and know-how

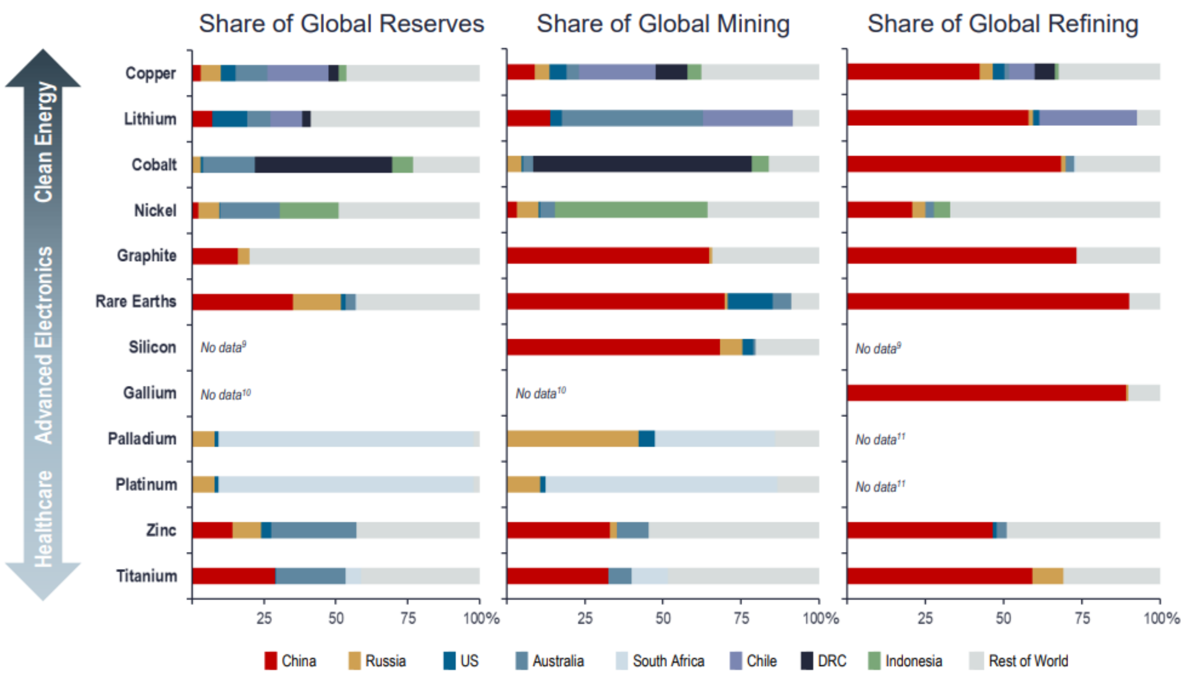
   This approach would also more effectively focus discussion between governments and with industry on how to manage the potential supply chain risks between Australian and partner government economies.

   For example, a list of Australian production capability (and its policy, technology, skills and capital constraints) could support discussion between governments and commercial entities on opportunities to deepen economic and non-economic partnerships and secure the supply of critical minerals, materials and technology manufactures. It would also facilitate dialogue on how Australian production might best be integrated into the supply chains of partner economies.

2. **For minerals that are currently on the list, or minerals that should be considered for addition to or removal from the list:**
   a. Which technologies does the mineral feed?
   b. What evidence is there of supply chain disruption relating to those minerals?
   c. What market, financing, technical or other barriers affect these supply chains?
   d. Are the barriers or supply chain disruption risks more acute in certain applications or levels of mineral grade or purity than others?

   The MCA recommends expanding the current Australian critical minerals list and has made recommendations for inclusion following a review of the technology requirements for Australia's transition and the critical mineral and strategic material lists of three of Australia's strategic partners. This initial review, the reasoning and the recommended additions are set out at Appendix A.

It is also necessary to take a dynamic view of the supply chain (minerals exploration, mining processing and then to materials and manufactures). Each will have unique conditions, including the time scale and potential for disruption along the supply chain. This can include geopolitical, technological, supply side, demand side or other economic disruption. An articulation of the geopolitical and constrained supply side risk is easily identified below (note copper, nickel, zinc as examples).



7. USGS 2022–2023, S&P Global Commodity Insights, Benchmark Mineral Intelligence, Rystad Energy, and other industry estimates.
8. Note: The order of these materials is based on their significance to the clean energy, advanced electronics, and healthcare sectors. However, most materials are used across all sectors. Rare earths, for instance, play an important role in cross-sector technologies.
9. Note: Silicon is the second-most abundant element in the Earth's crust, as more than 90% of the crust is composed of silicate materials. Silicon processing is intimately linked with the mining phase.
10. Note: As gallium is an element that is mostly contained in small amounts of bauxite and zinc resources, it is difficult to quantify, and its mining is not independently reported.
11. Note: The refining of platinum group metals, including palladium, is intimately linked with the mining production phase and is not reported separately.

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The government should undertake a deeper review of the critical and strategic material lists of its strategic partners (published or otherwise) in developing an Australian consolidated critical minerals and strategic materials list.

The review should consider how those lists intersect with Australia's mining, processing and manufacturing capability and the potential for growth and expansion further down the supply chain into manufacturing as part of those strategic partnerships. This level of co-operation to strengthen the security of supply chains in each economy will guide and deepen the economic, security and other ties through collaboration and co-investment.

3. **Should Australia differentiate between criticality or importance of minerals, and the capability to process them, through categories within the list or a separate category that sits alongside the list? This differentiation could reflect the size and maturity of markets and the different challenges or barriers faced.**

   Other countries have recognised value in establishing different categories or separate lists where minerals are prioritised. This differs from Australia's current approach and suggests that other lists are intended to serve multiple purposes (for example, to meet specific policy or research needs).

   Australia should not establish separate lists to prioritise minerals. A single, consolidated list, informed by the lists of critical minerals and strategic materials should guide policy, regulatory and investment efforts for governments and provide a source of information for the private sector.

   However, we should also ensure sufficient granularity around a list for those commodities that don't require direct Government assistance to be economic but would benefit from practices such as accelerated approvals for listed commodities as practiced in other jurisdictions (Canada, EU).

   The government should use a critical minerals and materials list to focus discussions with strategic partners. It should also develop a broader community and industry understanding of how the critical minerals and strategic materials are processed, transformed and used in the supply chains of the technologies and manufactures that will be deployed around the world. There would be value in highlighting alignment of critical minerals availability with the needs of our trading partners and the markets in which we wish to increase our trade and investment prospects. It is worth noting Canada's approach to its critical minerals strategy and critical minerals list in this regard.

4. What lessons could be learned from other countries' approaches or the ways in which they consider their criteria for listing critical minerals?

There are three different approaches to considering the criteria relevant to each country. Largely, each country has mapped its critical supply chains and identified points of vulnerability: geopolitical, sourcing and decoupling, supply-side, market and capital risks.

Each has then explored opportunities to mitigate those vulnerabilities in the short medium and long term (including through substitution, stockpiling, recycling, innovation, on-shoring, 'friend-shoring' and/or supply diversification).

What is evident is that each economy has a different list of critical inputs depending on where in the end-to-end supply chain for critical technologies and inputs the vulnerability lies, how they have decided to manage it and where their strength as an economy lies.

This shows up in the differences (and similarities) in the critical minerals and strategic materials lists which identify the minerals and materials that are critical to their economies and are not mined or processed onshore in sufficient volumes to offset the vulnerability. Canada's list, for example is less about what minerals it considers critical and more about attracting investment along its mining, processing and manufacturing value chains to build on its mining and processing capability and critical mineral endowment.

Australia's critical minerals list currently reflects its geological endowment but does not leverage its world leading mining, processing and early stage manufacturing capability. As noted in responses to questions 1, 2 and 3, Australia's critical mineral and strategic materials list should note Australia's mining, processing and early stage manufacturing capability across the spectrum of critical minerals and materials listed by Australia's strategic partners.

Australia's dialogue with its strategic partners must then be focussed on securing the end to end (mining, processing, refining, manufacture, complex manufacture, technology assembly) supply chains between Australia and its individual strategic partners.

5. What should trigger an update to the list? For example, global strategic, technological, economic or policy changes.

The lists should be updated as needed to maintain its currency.

At a minimum it should undergo a review as the lists of strategic partners are updated and changed. It should also be updated as part of discussions between governments – for example government dialogue on the Australia-US critical minerals and climate change ministerial compact dialogue and similar strategic supply chain and energy transition dialogues.

The list should also be updated where government regulatory processes delay the development of any part of the supply chain of a mineral or metal where there is a risk that its supply chain could be disrupted.

[1] Research Brief, Critical materials: Geopolitics, Interdependence and strategic Competition, Geopolitical _ Lazard 175 Geopolitical Advisory, research brief, May 2023

The additional minerals proposed for inclusion in the Critical Minerals List exhibit characteristics that suggest they are at risk of disruption. It is worth noting that, consistent with responses above, the Australian critical minerals and materials list is a list highlighting what Australia is able to *provide* and the *opportunity to invest in Australian mining, downstream processing and manufacturing* (as framed in the Canadian critical minerals list) rather than a list of critical minerals and materials Australia must source. A separate critical technologies list could highlight the gaps in Australia's technology needs.

Mineral	Use and essentiality	Vulnerability	Inclusion on key critical mineral and strategic material lists
Copper	Copper is essential to electrification due to its conductive properties. It is a primary input to renewable energy, electrical wiring, electric vehicles, smart phones, computers and motors. EV's contain approximately four times the copper in conventional cars.	**Demand –** copper demand is already increasing with accelerated electrification. McKinsey estimates electrification to increase annual copper demand to 36.6 million metric tons by 2031. Although current supply projections (restarts, certain or probable projects), and recycled production offer a pathway to 30.1 million metric tons, another 6.5 million tons of capacity (an additional 20 percent) remain to be found. **Production –** globally**,** the average time to move a copper deposit from discovery to mining is 20 years. **Refining capacity -** China has by far the largest refining capacity for copper (36 percent) and even higher actual smelter throughput. Chile, Japan and the USA (21 percent) are the next three countries with the second, third, and fourth most refining capacity. **Usage** - China's copper usage is larger than both its smelting and refining of copper. In 2021, China accounted for 54 percent of global refined consumption.	**Copper** EU strategic raw material list US critical material for energy list India, Canada, Republic of Korea, Japan critical minerals lists
Nickel	Nickel is widely used in stainless steel production rechargeable battery chemistries, electro-plating high strength alloys (aircraft engines, turbine blades, and armour plating).	Global demand for nickel is expected to increase by 44 percent by 2030, driven by high demand for use in electric vehicle batteries. Demand for nickel is also expected to be driven by stainless steel and specialist alloys for transport and defence purposes.	**Nickel** EU strategic raw material list US critical material for energy list

		Russia is a major supplier of battery-grade nickel, while industrial-grade nickel production has become increasingly concentrated in Indonesia with exports limited by Indonesia's export controls. A significant portion of Chinese nickel processing and manufacturing has relocated to Indonesia and now controls much of that industrial grade nickel production. The world's biggest nickel exporters by volume of nickel shipments in 2022 were: Philippines (80.2 percent of the world's total), New Caledonia (12.6 percent), Guatemala (4.5 percent).	US, India, Canada, Republic of Korea, Japan critical minerals list UK watch list
Bauxite Alumina Aluminium	Aluminium is used in almost all sectors of the economy including electricity transmission lines (cheaper than copper), alloyed for structural material for vehicles, aircraft and vessels, battery cathode material. The majority of global High Purity Alumina (HPA) is manufactured from aluminium. In Australia HPA is manufactured through the process of transforming alumina. This is less energy intensive than using aluminium as a feedstock. HPA is required for the production of synthetic sapphire used in the manufacture of LED lights and scratch-resistant glass used for smartphone screens. There is no substitute for HPA in this process, and these new products are driving global demand. HPA also plays a critical role in the future of the portable electronics and electric vehicles due to its capacity as a high-performance insulator in lithium-ion batteries.	Australian bauxite deposits are strategically important as the raw material for alumina, HPA and aluminium production. Bauxite is also a primary source of Gallium, which does not occur as a free element in nature, but as gallium compounds in trace amounts in zinc ores (such as sphalerite) and in bauxite. Australia has the second largest reserves (behind Guinea) of bauxite in the world and is currently the world's largest producer (100 Mt in 2022). Australia is the second largest producer of alumina in the world (20.3 Mt in 2022). China is by far the largest producer of Alumina. In 2022 Chinese production was 76 million metric tonnes. Australia, the world's second largest producer, produced 20 million metric tonnes. China was also the largest global aluminium producer, producing 40 million tonnes in 2022, followed by India (4 million tonnes), Russia (3.7 million tonnes). Australia, despite its reserves of bauxite, ranked 7^{th} producing 1.5 million tonnes of aluminium in 2022.	**Bauxite** EU critical raw material list Republic of Korea critical minerals supply list **Alumina** Republic of Korea, Japan critical minerals list **Aluminium** US critical material for energy list US, Canada, Republic of Korea, Japan critical minerals lists

	Bauxite is also used to leach some rare earth metals (ed yttrium, lanthanum, cerium, neodymium, and scandium)[1].	World aluminium and alumina production is highly concentrated in China (58 percent in 2022-23). China imports 83 percent of the world's bauxite. China imports 98 percent of Australia's exported bauxite.	
Molybdenum	Molybdenum is used to alloy steel and iron to improve hardness, temper embrittlement, resist hydrogen attack and sulphide stress cracking. Molybdenum-steel alloys will be essential if hydrogen increases its share of global energy supply. It also increases strength at elevated temperatures and improves weldability, especially in high strength low alloy steels. End uses include automotive, shipbuilding, aircraft, aerospace, drilling, mining, processing, energy generation, including boilers, steam turbines and electricity generators, pressure vessels, tanks and heat exchangers, chemical and petrochemical processing.	Molybdenum prices reached record highs in February 2023 on strong demand amidst deficits in key supply sources. While prices for the industrial metal have pulled back since then, the outlook for molybdenum remains robust. Prices for molybdenum are closely related to copper. The metal is often produced as a by-product of copper, meaning that molybdenum output tends to rise and fall depending on how much copper is being produced. China produces the vast majority of the world's molybdenum, mining about 100,000 tonnes per annum. Chile mine production was 44,000 tonnes per annum and the US mine production was about 42,000 tonnes per annum.	**Molybdenum** India, Canada, Japan critical minerals list
Phosphate	Phosphate rock is processed to produce phosphorous, one of the three key nutrients used in fertilizers (the other two are nitrogen and potassium). Phosphate can also be turned into phosphoric acid, which is used in food, fertilizer, animal feed and electronics. Phosphoric acid is also a byproduct of rare earth element processing. In addition to its importance as a fertiliser, phosphate is part of an emerging battery chemistry.	The top phosphate mining countries are China (85mmt); Morocco (40mmt); USA (21mmt); Russia (13mmt); Jordan (10mmt) percent of established resources are in Morocco and Western Sahara. Only four countries can refine high purity phosphorus for batteries today.	**Phosphate** EU critical raw material list Republic of Korea, India, critical minerals list UK Watchlist **Phosphorus** EU strategic raw material list Republic of Korea critical minerals supply list

[1] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bauxite#:~:text=Bauxite%20is%20the%20best%20and,used%20as%20a%20building%20material

Potash	Potash (water soluble potassium) is fundamental to agriculture. Potash is made of potassium, which is an essential part of the human diet. 95 percent of the world's potash is used in farming to fertilize food supply. As an essential nutrient for plant growth, potash is a vital link in global food supply chains. The demands on that supply chain are intensifying. While cultivated land area will remain almost static, the global population will be close to 10 billion by 2050.	Four countries – Canada, Russia, Belarus and China – produce around 75 percent of world potash supply. Demand for potash is expected to double by the late 2040s, by which point it could be a US$50 billion market. Potassium has no substitute in plant nutrition. Deficiency reduces resistance to drought, pests and diseases. More than 90 percent of the global demand for potash comes from agriculture and around 55 million tonnes of potassium chloride is applied as fertiliser annually. That is equivalent to 6kg per tonne of crop production, 40kg per hectare of harvested land or 7kg for each person on the planet.	**Potash** India, Canada, Republic of Korea critical minerals List
Zinc	Zinc is primarily used in metallurgy to galvanize steel and as an alloying metal to make bronze and brass. Its use as a galvanising material is critical to protecting the steel frames needed for onshore and offshore renewable energy installations and transmission line towers. It is also used as a battery material, and to make rubber and some medicines. Several other critical minerals are sourced from zinc deposits, including **gallium**, **germanium** and **indium.** The smaller volumes of gallium, germanium and indium required in technology manufactures means that they are rarely, if ever economic to mine on their own.	The US Geological Survey notes: China was the top zinc producer / smelter in 2021 and 4.2 million tonnes (one third of the world's zinc production). This was followed by Peru (1.6 million tonnes); Australia (1.3 million tonnes); India (810 thousand tonnes); and the USA (740 thousand tonnes). Gallium, Germanium and Indium do not occur as free elements in nature, but as compounds in trace amounts in zinc ores (such as sphalerite) and in bauxite. Gallium, Germanium and Indium are produced exclusively as by-products during the processing of other metal ores including zinc and bauxite.	**Zinc** US, Canada, Japan, Republic of Korea critical minerals lists **Indium** US, India, Canada, Republic of Korea, Japan critical minerals lists **Germanium** EU Critical Raw Material list US, Canada, Republic of Korea, India, Japan critical minerals lists **Gallium** EU critical raw material list US critical material list India, Canada, Japan, Republic of Korea, USA critical minerals lists

High quality metallurgical coal	Metallurgical coal is currently an essential ingredient in the production of steel, making it one of the most widely used building materials on earth. It takes around 770 kilograms of coal to make one ton of steel, with approximately 70 percent of global steel produced in basic oxygen blast furnaces. Metallurgical coal or coking coal is a grade of coal that can be used to produce good-quality coke. Coke is an essential fuel and reactant in the blast furnace process for primary steelmaking. The demand for metallurgical coal is highly coupled to the demand for steel.	European steelmaker access to metallurgical coal has been constrained by sanctions on Russia, a major supplier of coking and thermal coal to European energy and steelmaking facilities. As global decarbonization drives up demand for steel associated MET coal supply is expected to come under pressure. Steel industries including in the EU and across Asia are wary of tight physical supply conditions for MET coal driven by supply-side underinvestment and geopolitical constraints to supply. This has been underpinned by the inclusion of metallurgical coal on the EU Strategic Raw Materials List. Australia is the major global supplier of premium quality metallurgical coal to the world's steel makers. Australia imports about 33 percent of its steel and steel manufactures. In 2022, Australia's imports of Articles of iron or steel was US$7.39 billion.	**Metallurgical coal** EU strategic raw material list Republic of Korea critical minerals supply list
Uranium	Australia has approximately 28 percent of the world's known uranium resources. However, it produces only 12 percent of global supply. Currently, around 9 percent of global electricity is generated from nuclear energy. The International Energy Agency states that achieving the aims of the Paris Agreement will require an increase in nuclear power. In some OECD countries, uranium is considered a fuel mineral rather than a critical mineral. However, in the Australian context, uranium should be considered a critical mineral for its role in medical and industrial isotope production, and for supporting energy security in trading and geostrategic partner countries (Canada, USA, UK, EU, Japan, India and the Republic of Korea) and	Current state and federal policies do not leverage Australia's capacity to contribute to global emissions targets through nuclear energy. Australia has developed a patchwork approach to uranium mining, with policy variations across the states ranging from total bans on exploration and production, to well-established regulatory regimes from exploration to export of U3O8. Russia's invasion of Ukraine provided a clear demonstration of vulnerabilities in the nuclear fuel cycle for western countries. Russia is dominant in the supply chain, with one third of global conversion and 43 percent of enrichment. The US is examining the security of the nuclear fuel cycle. As the only OECD country with a ban on nuclear energy, Australia is missing an opportunity to value-	**Uranium** Canada critical minerals list

	domestically for its role medical and industrial isotope production. The United States Congress has passed a number of initiatives[2] to drive nuclear energy for domestic use. Provisions in the bipartisan *Infrastructure Investment and Jobs Act* and the *Inflation Reduction Act*, as well as nuclear energy research and development funding of US$18 billion in FY23[3] indicates a strong desire for this to be part of the global transition to net zero. Japan has recently announced it will cooperate with the US to develop the next generation of advanced light water and small modular reactors. Canada's government has taken an additional step, making its first C$970 million commitment to developing a small modular reactor in October 2022. Europe, Sweden and Finland are also exploring nuclear expansion.	add through conversion, enrichment and (potentially) fuel fabrication. Doing so would reduce reliance on Russia and build linkages with strategic partners. Questions also remain on Australia's future capacity to develop the workforce required for a fleet of nuclear-powered submarines. Failure to create career pathways within a civilian broader nuclear fuel cycle may strand our strategic defence assets.	

[2] Efforts to Transform US Nuclear Industry Entering Full Bloom - AIP.ORG
[3] The State of Play for Nuclear Energy in the United States | Briefing | EESI