



Australian Government

Australian Trade and Investment Commission

Opportunities in Korea for Australian critical minerals

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Opportunities in Korea for Australian critical minerals

Korea's battery industry has an important and urgent role to play as the world moves to tackle the challenges of reaching net zero by 2050. Korean electric vehicle (EV) manufacturers and their battery suppliers are developing battery supply chains that will drive demand for Australia's critical minerals and new downstream processing industries, and deliver significant economic benefit to Australian industry.

In the global EV race, these Korean companies are also placing big bets on new plants in Europe, Asia and the US to meet EV demand. Ongoing investment in mineral exploration, extraction and processing of lithium, cobalt, manganese, nickel, phosphate, graphite and rare earths will also be required on a significant scale. To capitalise on these opportunities, Australian and Korean companies and public and private funding agencies will have to work closely to align benefits, mitigate risk and develop new supply chains.

As of November 2022, South Korea's three major battery makers – LG Energy Solution, Samsung SDI and SK – had a combined 23.1% share of the global battery market (LG Energy Solution, 12.3%; SK On, 5.9%; Samsung SDI, 4.9%).¹ The companies supply EV batteries to global automakers such as BMW, Volkswagen, Audi, Stellantis, GM, Volvo, Ford Motors and Hyundai.

The battery companies also have the support of Korea's conglomerates, including POSCO Holdings, L&F Co., SungEel HiTech, S3R, LG Chemical and Korea Zinc. These companies are leaders in cathode and anode active materials, electrolytes, separators and recycling. POSCO, for example, has 8% of the global cathode market and 33% of the global anode market.

Alliances between automakers and battery manufacturers are expected to further strengthen. The demand for EVs and developments in high-performance battery technology is also increasing.

In addition to automotive assemblers like Hyundai-Kia Motors, key end-users of high-power Rare Earth Element (REE) magnets in Korea include:

- advanced consumer electric appliance makers (such as Samsung and LG Electronics)
- defense companies (such as Hanwha Defense, LIG Nex1, KAI, Hyundai Rotem).

As these groups usually have overseas manufacturing bases in the US, the European Union and ASEAN nations (such as Vietnam and Indonesia), the Australia-Korea Partnership in the REE supply chain will naturally trickle down to the global market. The Indo-Pacific Economic Framework (IPEF) could also serve as a springboard for Australia-Korea efforts.

Of the eight Korean magnet companies, six list NdFeB group magnets in their product lines. The companies import almost-finished NdFeB intermediate products mostly from China, which undergo final processing such as cutting into final shape, heat- and surface-treatments in Korea for local assembly. Three companies are known to have either core processing technologies or significant processing capacity such as for grain boundary diffusion processing and strip casting.

Market leaders such as Star Group develop high-performance, high value-add products for domestic and global end-users.

Joint ventures between Korean battery manufacturers and automakers

BATTERY MANUFACTURERS	AUTOMAKER
LG Energy Solution	GM Motors: Ultium Cells: 1st plant (35 GWh per year) in Ohio, 2nd plant (35 GWh per year) in Tennessee, 3rd battery plant in Michigan
	Stellantis: NextStar Energy to build first large-scale, EV battery manufacturing facility in Canada, producing lithium-ion battery cells to supply Stellantis' vehicle production in North America
	Hyundai Motors: A joint venture company to build a battery factory in Indonesia, manufacturing nickel, cobalt, manganese and aluminum cathode batteries with a capacity of 10 GWh per year
Samsung SDI	Volvo: A joint development of battery packs specially developed for Volvo Group's electric truck applications
	Stellantis: A joint venture to build an EV battery plant in the US. The plant will supply battery modules for Stellantis' production in North America (23 GWh by 2025)
SK on	Ford: BlueOval, a joint venture company with Ford, will build three plants in the US with a combined capacity of 129 GWh

Korean companies that use NdFeB magnets

COMPANY	ALLOYS	NDFeB*	SMCO	FERRITE	ALNICO	PARTS	MOTORS
Pacific Metals		•	•	•	•		
Korea Strategic Minerals	•	•					
Star Group*		•	•	•	•		
Jahwa Electronics*		•	•	•	•		
Nanotech (Jahwa Electronics' sister co.)		•	•	•	•		
Novatech		•	•	•	•		
Ugimag Korea				•	•	•	•
Union Materials				•		•	

*Jahwa has NdFeB strip-casting capacity, and Star Group facility is under construction. Sources: Desk research and interviews by author

¹ SNE Research, K-trio Battery Makers Taking Up 23.1% of Market Share in Global EV Battery Usage From Jan to November 2022, 4 January 2023

New strategies to secure critical minerals

The Korean Ministry of Trade, Industry and Energy (MOTIE) defines 33 elements as critical minerals. The definition reflects the significance of these minerals to Korea's advanced industries such as semiconductors and batteries. It also reflects the inherent supply chain risks of these elements.

The 10 elements in bold are essential for Korea's EV and semiconductor industries.

- **Lithium, nickel, cobalt, manganese, graphite**, niobium, copper, aluminium, silicon, magnesium, molybdenum, vanadium, tin, titanium, tungsten, antimony, bismuth, chromium, lead, zinc, gallium, indium, tantalum, zirconium, strontium, selenium
- Rare earths: **lanthanum, cerium, neodymium, terbium, dysprosium**
- Platinum: platinum, palladium.

On 27 February 2023, MOTIE's Minister Lee hosted a business roundtable in Seoul where he released new strategies to secure these critical minerals. The strategies are listed below.

Develop systems to protect critical minerals supply chains

Korea will work to develop and protect its global mining and supply chains. It will develop an early warning system to detect risks to supply chains and extend the stockpiling period from the current 54 days to 100 days by 2031. It will also undertake a preliminary feasibility study to build a stockpiling facility dedicated to critical minerals. In addition, it will work on a quick release program to prevent economic disruption.



Further strengthen of bilateral and multilateral cooperation

Korea will work on strengthening bilateral and multilateral cooperation on critical minerals to help secure and protect supply chains.

In December 2020, Korea's President Moon visited Australia. During the visit, Australia and Korea took significant steps to strengthen bilateral cooperation in critical minerals supply chains.

Initiatives included the signing of a Critical Minerals Supply Chain Cooperation Memorandum of Understanding (MoU) and the Low and Zero

Emissions Technology Partnership Implementation Plan. These agreements lay the foundation for advancing bilateral cooperation on critical minerals and clean energy solutions.

The Critical Minerals Supply Chain Cooperation MoU will strengthen cooperation in critical mineral supply chains including bilateral trade and investment in critical minerals. Practical steps include establishing a critical minerals working group comprising governments, businesses, research institutes and financial firms.



The working group will work to increase collaboration such as initiating joint investment and R&D projects across minerals development and production. Korean and Australian business delegates met twice in 2022 to share information on projects and opportunities.

Explore new critical minerals projects

State-owned enterprises (SOEs) such as KOMIR and KEXIM will take a lead on higher-risk exploration projects to revitalise overseas resources development among private businesses. SOEs will initially conduct early-stage feasibility on new projects proposed by multilateral cooperation organisations before encouraging private-sector businesses to participate.

To support this initiative, the Korean Government will increase public financing such as loans, guarantees and insurance for mine development, processing and imports. KEXIM will make direct loans for overseas investment and K-Sure will provide debt and insurance support.

Reintroduce a tax credit program

The Korean Government will reintroduce a tax credit program for overseas resource developments (this was abolished in 2013). The program will broaden the scope of deductible expenses should write-downs or impairments eventuate.

Develop a battery recycling ecosystem

Korea will develop a battery recycling ecosystem for waste generated from EVs and batteries. This will include a demonstration centre and a sector cluster to support SMEs.

The Korean Government will develop a new legal framework to support these initiatives. It will also look to build expertise in mineral beneficiation, smelting and recycling and drive thrifting and substitution.

Collaborations between Korean and Australian companies

According to S&P Global Market Intelligence, more than A\$500 million in investments have been pledged by South Korean corporates to Australian mining projects in the past two years alone.² Some examples of collaborations are listed below.

LG Energy Solution

LG Energy Solution (LGES) is one of the world's largest battery-makers. The company has agreements with Queensland Pacific Metals (QPM) and Liontown Resources.

LGES has a 7.5% stake in QPM. Under a 10-year contract, QPM will provide 7,000 tonnes of nickel and 7,000 tonnes of cobalt per year to LGES.³ The supply is scheduled to start in late 2023. This will lay the groundwork for closer cooperation between the two countries.

LGES also has an offtake agreement with Western Australia's Liontown Resources for lithium concentrate. Under the agreement, LGES will secure 700,000 tonnes of concentrate from 2024 to 2028.⁴ There is an option to extend the supply contract for another 5 years.

POSCO

POSCO is the world's sixth largest steel producer and one of the largest suppliers of lithium-ion battery materials.

The steel group regards battery materials as its next growth engine. In December 2020, POSCO Holdings Chairman Choi Jeong-woo stated that POSCO's goal was to become a top player in the global battery materials market. The company would do this by speeding up the completion of its integrated battery value chain. This would allow it to process 300,000 tonnes of lithium and 220,000 tonnes of nickel by 2030.

POSCO Future M (formerly POSCO Chemical) is the affiliate which specialises in manufacturing cathode and anode battery and the precursor materials. POSCO currently manufactures NCM, NCA, NCMA and is developing LFP materials.

POSCO supplies LG Energy Solution, Samsung SDI and SK On and global OEMs. The company has a three-year contract worth US\$1.6 billion to supply high-nickel materials to LG Chemical. It also has a US\$30.6 billion contract to supply Samsung SDI with NCA cathodes over 10 years.

To meet demand for products such as High Ni NCM, NCA and LFP lithium-ion batteries, POSCO is aiming to produce 605,000 tonnes of cathode materials and 320,000 tonnes of anodes from artificial and flake graphite by 2030.⁵ In March 2023, it announced the construction of a new battery materials plant in Korea to meet this goal. POSCO has cathode plants in Korea, China and Canada and anode plants in Korea.

POSCO needs lithium, nickel, cobalt, manganese, graphite and aluminium. The company sources these minerals from the global market and through its own integrated investments via POSCO International. POSCO has agreements with Australia's Ravensthorpe Nickel Mine, Renascor Resources and Pilbara Minerals.

Ravensthorpe Nickel Mine

In 2021, POSCO signed a \$240 million deal to acquire a 30% stake in the Western Australian Ravensthorpe nickel mining company from First

Quantum Materials. POSCO also committed to a long-term offtake agreement for nickel-cobalt hydroxide precipitate. The Ravensthorpe investment demonstrates POSCO's vertical integration strategy, which strengthens its status as a supplier of key materials for the EV batteries market.

Renascor Resources

POSCO has a strategic investment and offtake MoU with South Australia's Renascor Resources. The MoU covers the purchase of 20,000 to 30,000 tpa of purified spherical graphite. The graphite will be sourced from Renascor's Siviour graphite mine and planned Battery Anode Material business in South Australia. The MoU also provides for POSCO to make a potential equity investment in Renascor.

Renascor's graphite project has the second largest reserves of graphite outside Africa. The MoU will help POSCO de-risk its supply chain and create a new graphite industry in Australia.

POSCO owns and operates natural and flake graphite plants in Korea.

Pilbara Minerals

POSCO and Pilbara Minerals have a joint venture called POSCO-Pilbara Minerals Lithium Solutions Co., Ltd. Pilbara Minerals has an 18% share in the JV, with an option to scale up to 30%. POSCO also owns 2.75% of Pilbara Minerals and has an offtake agreement for 315,000 tonnes.⁶ Participation in the JV supports Pilbara Minerals' long-term strategy of becoming a fully integrated raw materials company.

POSCO is building a US\$800 million lithium hydroxide plant in the Korean southern industrial port city of Gwangyang. Scheduled for completion in 2023, the plant will process 43,000 tonnes of spodumene supplied from Pilbara Minerals.

SK On

SK On was established in October 2021 as a wholly owned subsidiary of SK Innovations. SK Innovation Co. Ltd. is the holding company of SK Group, which

is engaged in petroleum, alternative energy, and oil exploration. It runs its business through six major subsidiaries, including SK On, SK Energy, SK Geo Centric, SK Lubricants, SK Incheon Petrochem, SK Trading International, and SK IE Technology.

SK On's core business areas include EV batteries, battery-as-a-service (Baas) and Energy Storage Systems (ESS). The company supplies batteries to Hyundai Motors, BAIC and Daimler AG.

In 2022, SK On signed an MoU with Australia's Global Lithium Resources to explore future offtake agreements in lithium supply, joint investment, and development of downstream lithium assets.

Hyundai Motor Company

Hyundai Motor Company is a multinational automotive manufacturer. The company is part of the larger Hyundai Motor Group, which also includes Kia Motors. Hyundai Motor Company has been a global player in the development and production of EVs for several years.

In 2022, Hyundai Motor Company and Kia Corporation signed a binding supply agreement with Arafura Rare Earths. The deal covers up to 1,500 tonnes of NdPr oxide or its equivalent in NdPr metal per year from the Nolans Project over a seven-year term. Subject to project financing, the supply is expected to start in 2025 when the construction and development of the Nolans project is completed.

Australian Strategic Materials (ASM)

ASM acquired a Korean technology startup company, with which it recently opened a Korean metals plant. ASM is engaged in networking with Korean magnet producers and public sector research institutes to establish a robust mine to midstream integrated supply chain.

Arafura Resources

Arafura Resources has signed a binding agreement with Hyundai Motors Group for the future supply of REE.

² S&P Global Market Intelligence, Australian critical minerals deals a prelude to vast South Korean investments, 15 December 2021

³ LG Energy Solution, LG Energy Solution to have 6-year access to nickel and cobalt from Australian Mines, August 2021

⁴ Business Korea, LG Energy Solution secures 700,000 tons of lithium concentrate in Australia, 3 May 2022

⁵ Business Korea, POSCO to make huge investment to secure battery minerals, 12 May 2022

⁶ S&P Global Market Intelligence, Pilbara Minerals, POSCO form JV for South Korea lithium conversion facility, 25 October 2021



Contact us

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