

Global secondary lead production: Update and developments to watch

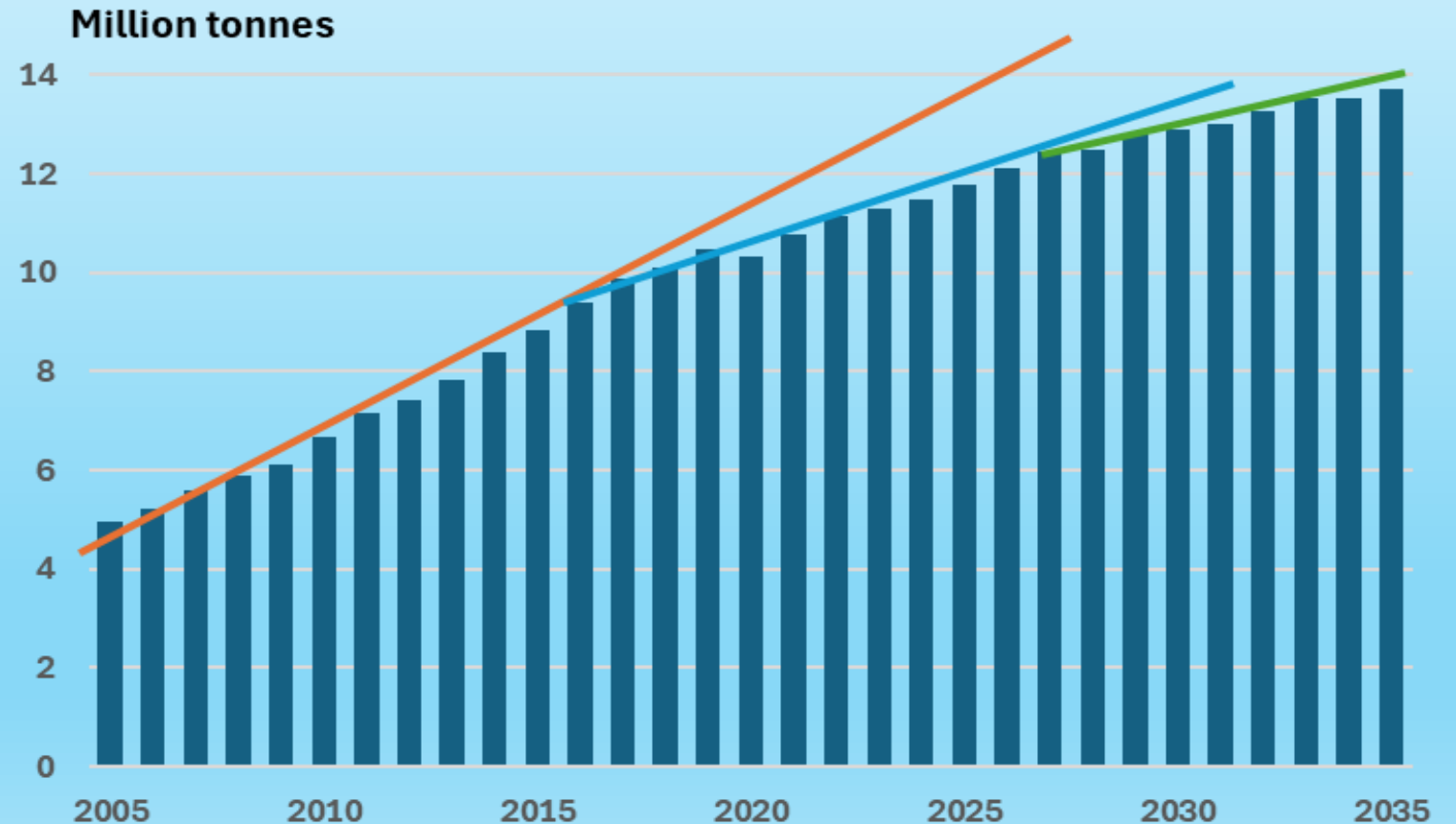
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RECYCLE 100
9TH INTERNATIONAL SECONDARY LEAD & BATTERY RECYCLING CONFERENCE
Kota Kinabulu September 2025

Rate of growth in global secondary lead production is slowing

- Secondary lead production grew at annual average rate of 6% in 10 years to 2015
- Pace expected to be only 3% per annum in 10 years to 2025...
- ...and slowing further over the next 10 years
- Significant increase overall reflects dominant battery end use and exceptionally high recycling rates

Secondary lead from scrap batteries, residues & other lead-bearing waste



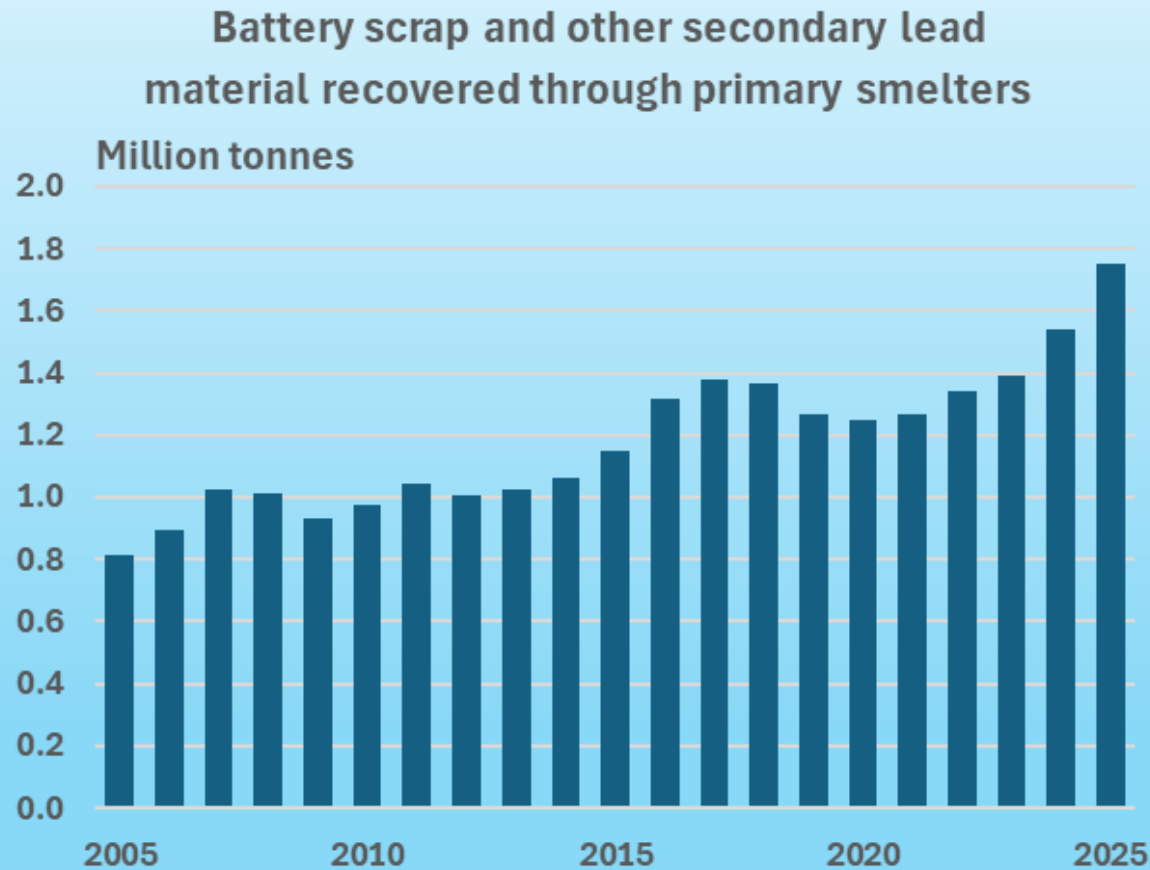
September 2025

Slide 2

Growth in availability of battery scrap to slow

- Share of battery electric vehicles in global vehicle fleet is growing
- Growth most rapid in China followed by Europe
- Auxiliary batteries in EVs most often lead batteries but lithium gaining market share
- E-bike and e-trike fleet in China unlikely to grow, but remains largely powered by lead batteries
- ICE vehicle fleet growing in “global south” countries, but remains much smaller than in the mature economies of Europe and North America
- Countries with fast growing vehicle fleets often associated with shorter battery lives increasing supply of battery scrap

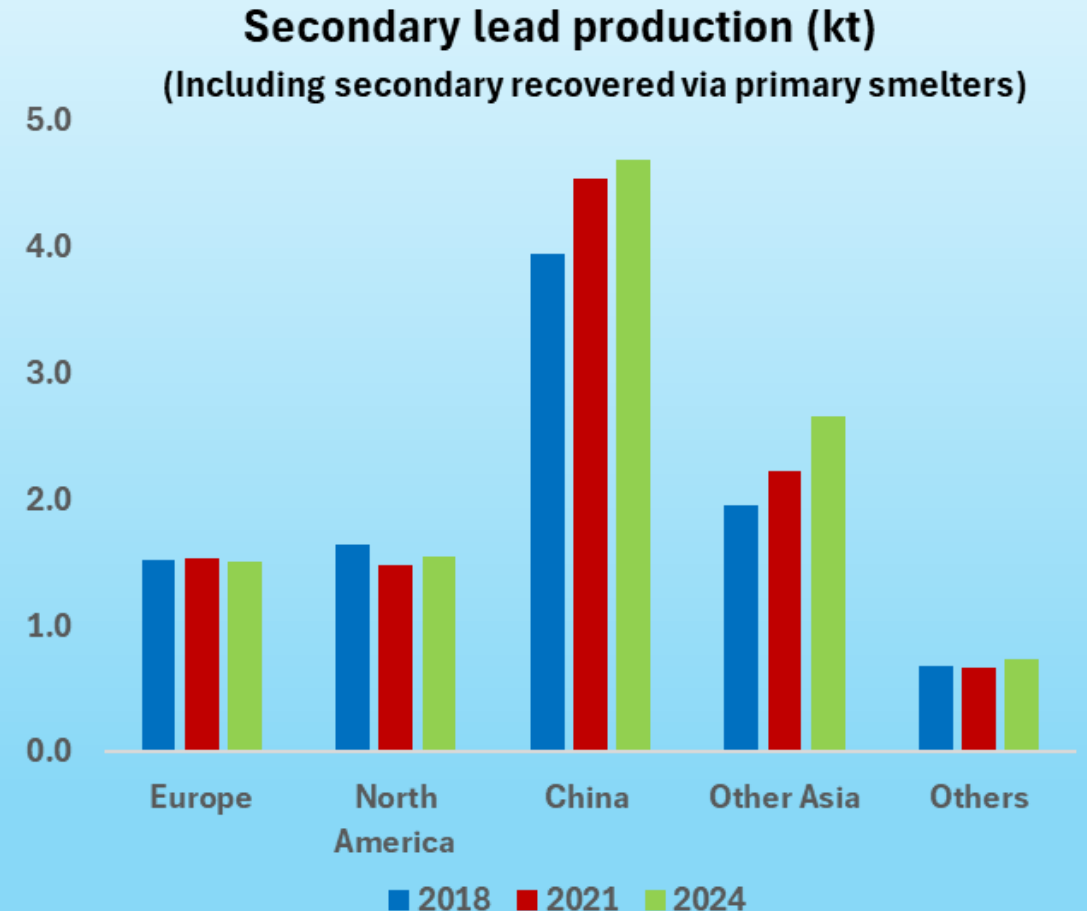
Share of battery scrap is processed through primary lead circuit



- Most primary lead smelters process lead concentrates and a share of secondary lead-bearing materials
- Tight concentrate markets encourage primary smelters to increase share of battery scrap in feed
- Other materials include zinc leach residues and copper dusts from copper smelters...
- ...industrial lead-bearing wastes, TV glass, etc
- Rapid increase since 2022 reflects expansion in China and recovery of output in Europe

Secondary lead production by region

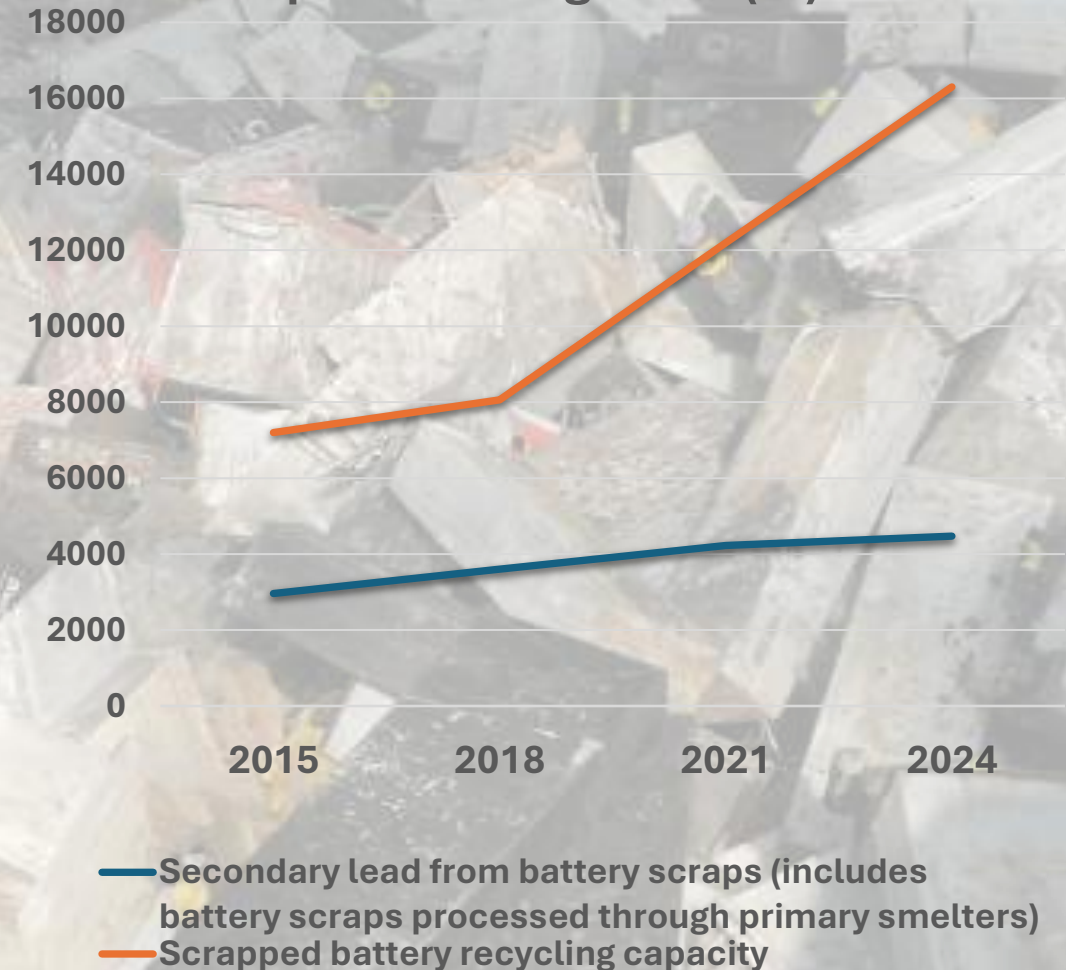
- China accounts for 40% of global secondary lead production
- Production size and rapid growth due to expansion of vehicle fleet and increase in e-bike/e-trike numbers
- Secondary output in Europe and North America unchanged in recent years as growth in vehicle fleets has slowed
- North American battery scrap is flowing to Asia, helping to boost Asian secondary output, especially in India and Korea



Secondary Pb developments in China

- Growth in capacity to recycle battery scrap has been much faster than secondary lead production since 2018
- Some plants in more remote locations with very limited access to battery scrap
- Intense competition for battery scrap keeps prices very high
- Much of the industry operates at a loss despite efforts to support producers through various measures
- Few plants can achieve steady operation often closing temporarily to accumulate scrap inventory
- Based on scrap and refined lead prices losses are likely to be -400 ~ -600 rmb/t

China scrapped battery recycling capacity and secondary Pb production growth (kt)



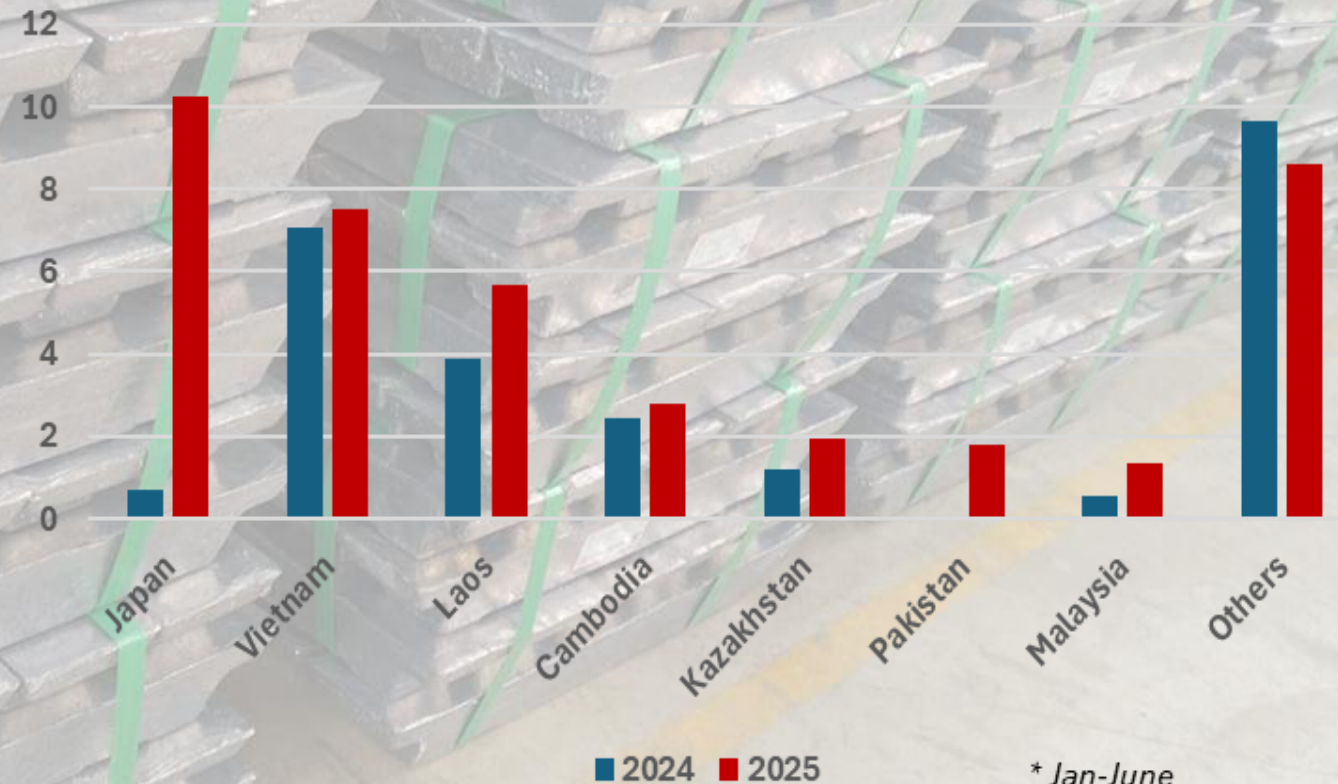
China's secondary lead producers seek to increase import of secondary bullion

- China has a massive capacity surplus in facilities to process lead battery scrap – and is continuing to add to this surplus
- Consequence is that competition for secondary feed has driven price of battery scrap sky high relative to underlying price of refined lead
- Companies would like to import battery scrap, which is banned, or failing that, set up recycling operations offshore to produce secondary bullion for import into China – bypassing ban on importing battery scrap
- If pursued, this development would result in a significant rebalancing of international trade in refined lead and guarantee a permanent structural surplus in China's domestic lead market

Not all the lead imported into China is refined ingot or a recognised battery-grade alloy!

- China has imported lead alloys in various quantities over many years
- A recent development is rising imports of what we assume is secondary lead bullion
- Lead alloy (780199) imports in 2024 totalled 69kt, imports in 2025 to June total 40kt

China: Lead alloy imports YTD* 2024 & 2025 (kt)



* Jan-June

Lead recycling in Asia ex-China



Sources: CHR estimates & ILZSG

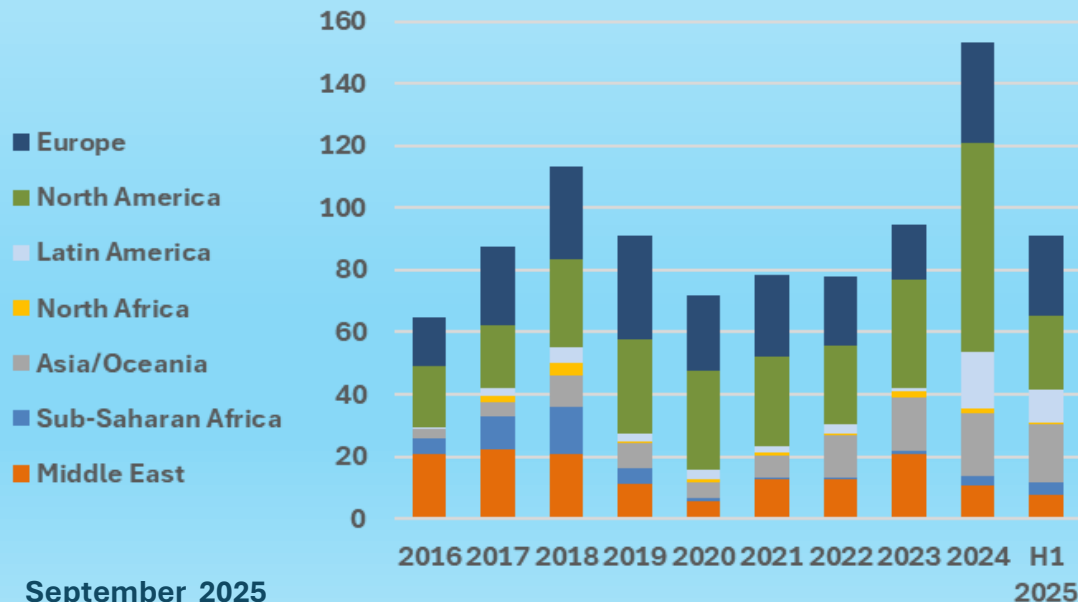
- India has experienced fastest growth in recycled lead output in recent years
- Little change in Korea
- Moderate growth in other countries
- Small increase in Japan partly the result of ban on battery scrap exports to Korea in 2016

Indian secondary lead production

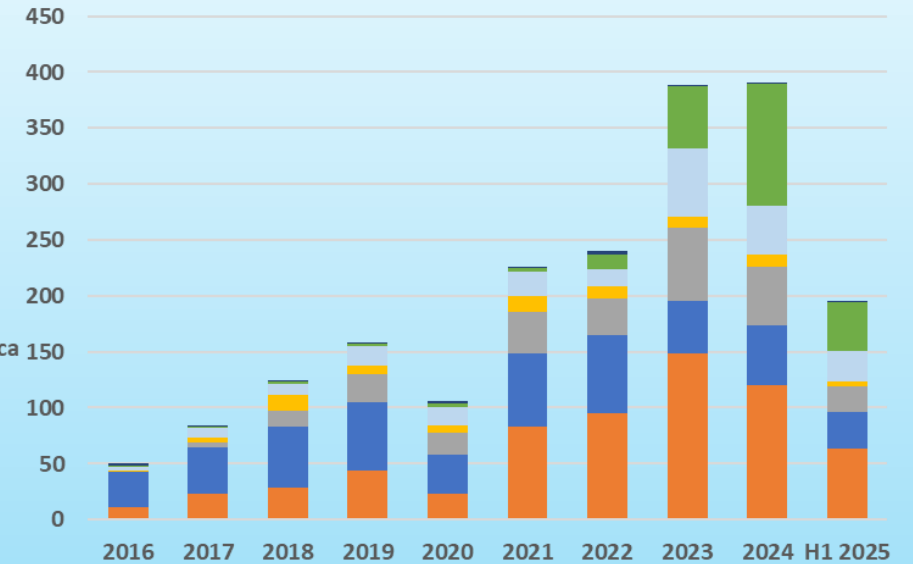
- Domestic availability of battery scrap is increasing with more vehicles on the road, use of inverter batteries and growing number of electric rickshaws
- Ban on importing battery scrap lifted in 2016



India - lead scrap imports (kt)



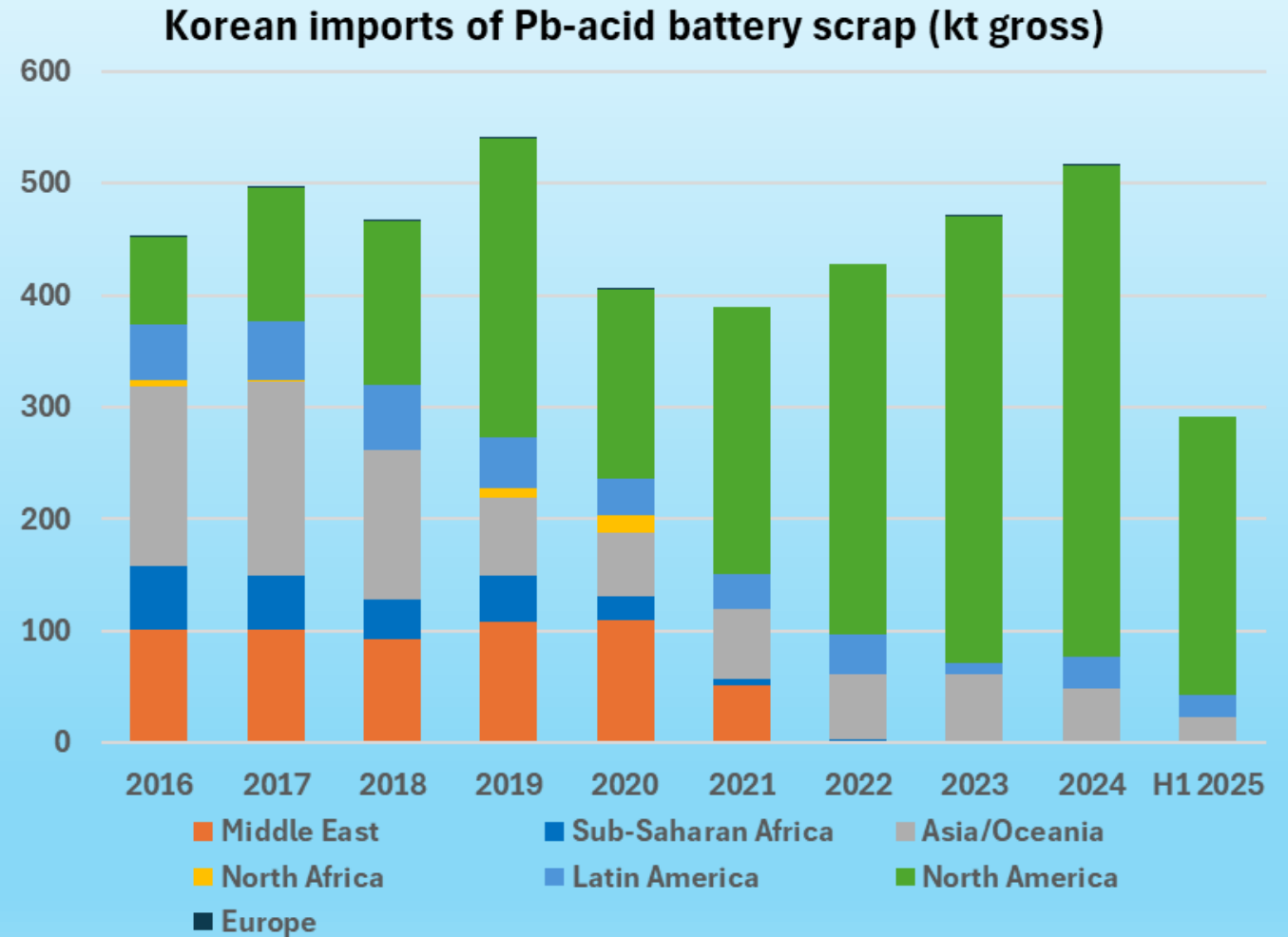
Indian imports of Pb-acid battery scrap (kt gross)



- Lead scrap imports are a mix of conventional lead scrap (cable sheathing, old pipes, spent anodes, etc) but also battery plates
- Significant imports from North America and Europe
- Imports still growing in 2025

Korean secondary lead production

- Imports of battery scrap steady over several years
- Higher share of battery scrap from North America in recent years
- Indian scrap buyers appear to have taken Korean market share from Middle East and Africa

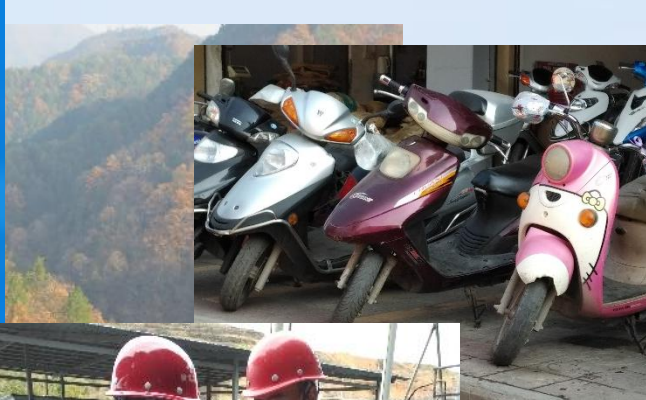


Developments to watch

- Global lead consumption in SLI batteries (including auxiliary batteries) will likely peak before 2035
- In China, the world's leading adopter of electric vehicles, use of lead in SLI batteries may have peaked in 2024, even taking into account exports of SLI batteries
- Domestic availability of SLI battery scrap in China is already on a declining trend...Chinese secondary lead producers importing bullion for refining
- Europe is region most likely to follow China's path in adopting electric vehicles with a ban on sale of non-electric vehicles due to come into force in 2035
- Continued sales of ICE vehicles beyond 2035 in most other regions means continued growth in SLI battery recycling elsewhere , albeit at a slow pace
- There is a risk that low voltage lithium batteries will increase market share faster than expected and undermine demand for lead SLI batteries

Outlook

- Lead producers, especially miners, need to support programmes developing existing and new end-uses for lead batteries to offset gradual loss of SLI market
- In terms of volume, best prospects for growth in use of lead batteries are in promoting two and three-wheel e-bikes in India, Vietnam and Indonesia, highlighting low cost, safety and existing closed-loop recycling of lead batteries
- There is significant potential for the use of lead batteries in expanding markets providing back-up systems for data centres and energy storage
- Retaining market share and expanding into new markets is key for the long-term health of a global lead battery recycling infrastructure



CHR Metals

- Providing independent, detailed analysis and forecasts of global lead and zinc industries
- Covering all aspects of mine and smelter supply and end-use consumption
- Data from original sources wherever possible
- A particular focus on Chinese market
- Offices in the UK and Xi'an
- Clients include producers, consumers, traders and hedge funds

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