C H R Metals

Asian lead market review

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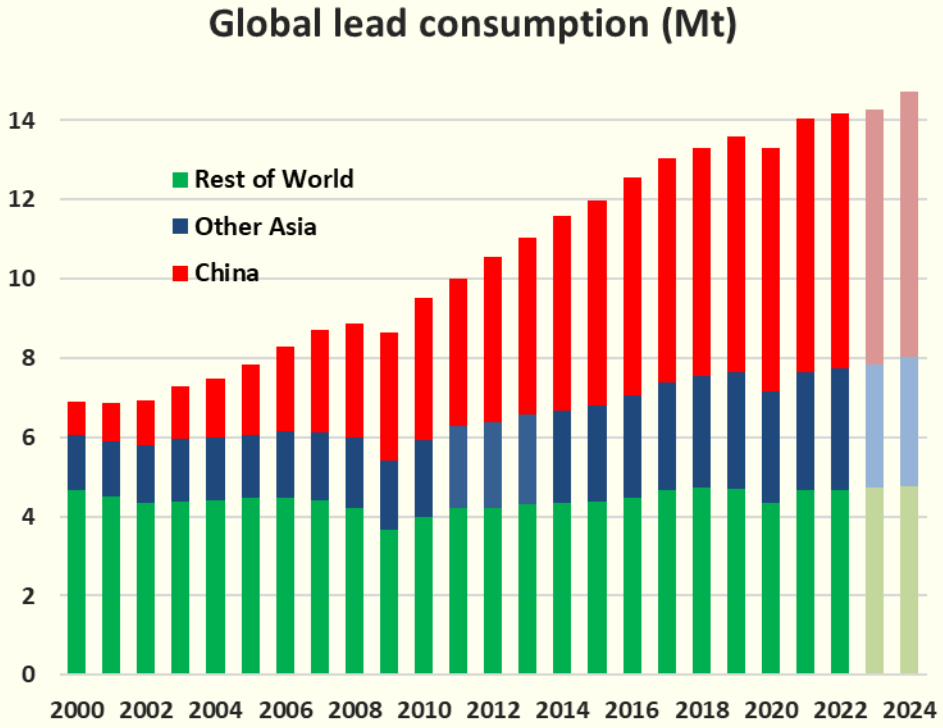
Presentation Outline

- CHR Metals
- Evolution of global lead demand and supply
- China's dominance of both Asian and global lead demand
- India – a major market for lead with opportunities for continued growth in non-SLI battery applications
- Lead demand elsewhere in Asia
- Closing comments

Introduction to CHR Metals

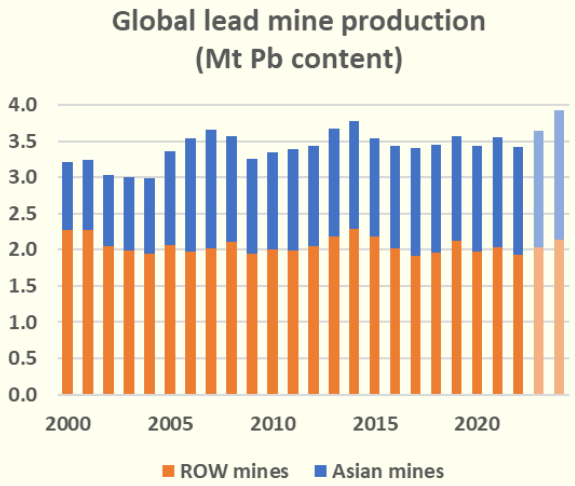
- CHR Metals established in 2000 to provide independent, detailed analysis and forecasts of global lead and zinc industries
- Covering all aspects of mine and smelter supply and end-use consumption
- Data from original sources wherever possible
- A particular focus on Chinese market
- Providing detailed data and market reports
- Offices in the UK and Xi'an
- Clients include producers, consumers, traders and hedge funds

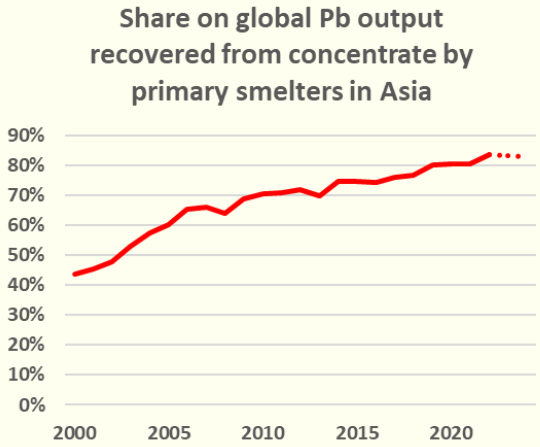
Evolution of global lead demand

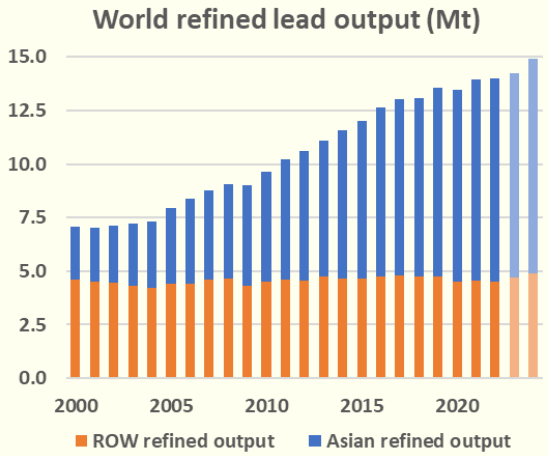


- Asia's share of global lead demand has grown from 25% in 1990, to 33% in 2000 and 67% in 2022 (9.5Mt)
- Story is as much about growth in Asia as stagnation in the rest of the world
- Lead demand ex-Asia was 4.7Mt in 2000 and almost unchanged in 2022
- Ex-Asia there has been growth in lead use in batteries, but offset by fall in some non-battery uses, especially chemicals, solders, etc
- Demand for lead in mature economies of Europe and North America also affected by competition from Asian battery manufacturers, both in domestic and export markets
- Growth in lead demand in Asia underpinned by use in batteries, both SLI and industrial

Global lead supply

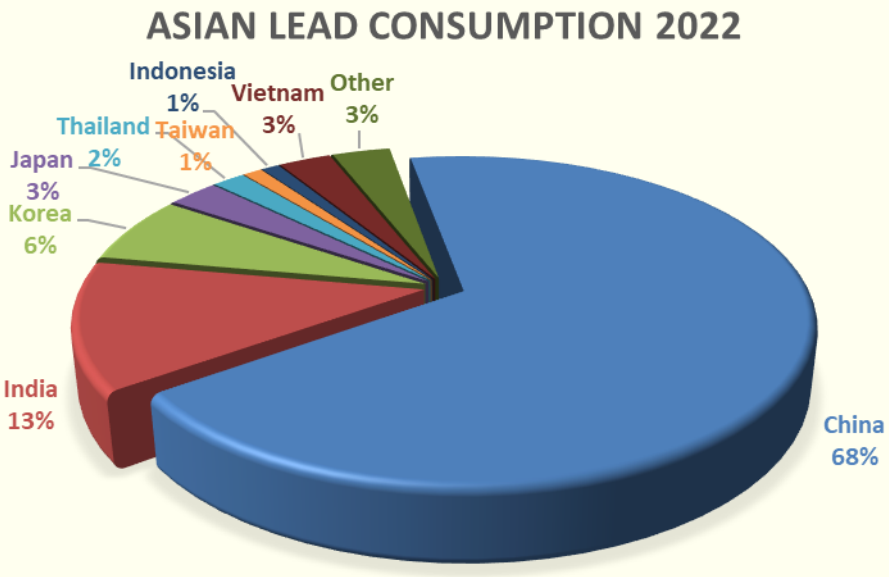






- More lead is mined in countries outside Asia, but Asian smelters now process more than 80% of all lead-containing concentrates
- Asian primary and secondary production currently accounts for two-thirds of total global refined lead production, roughly matching its share of global demand

Asian markets critical for lead demand

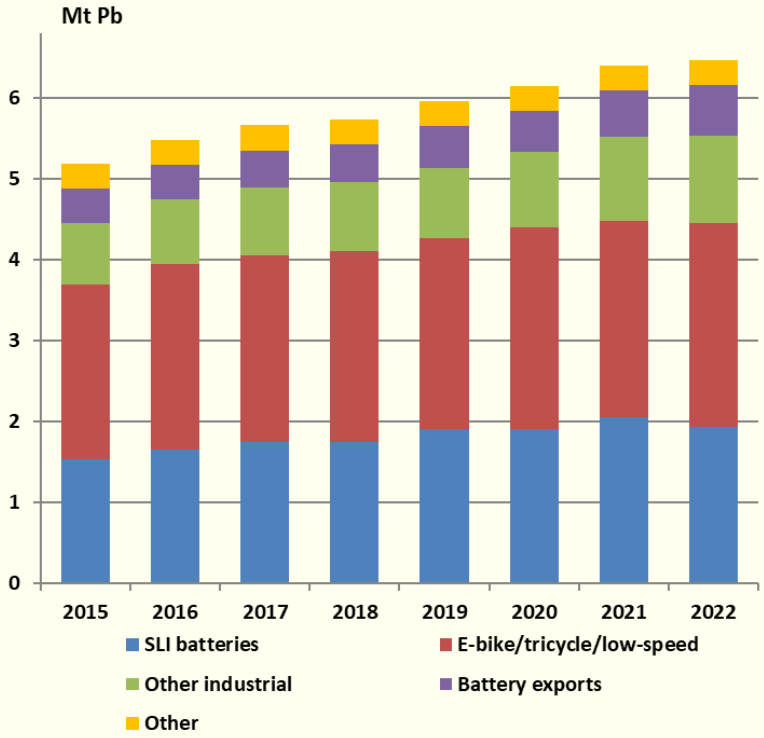


CHR Metals estimates

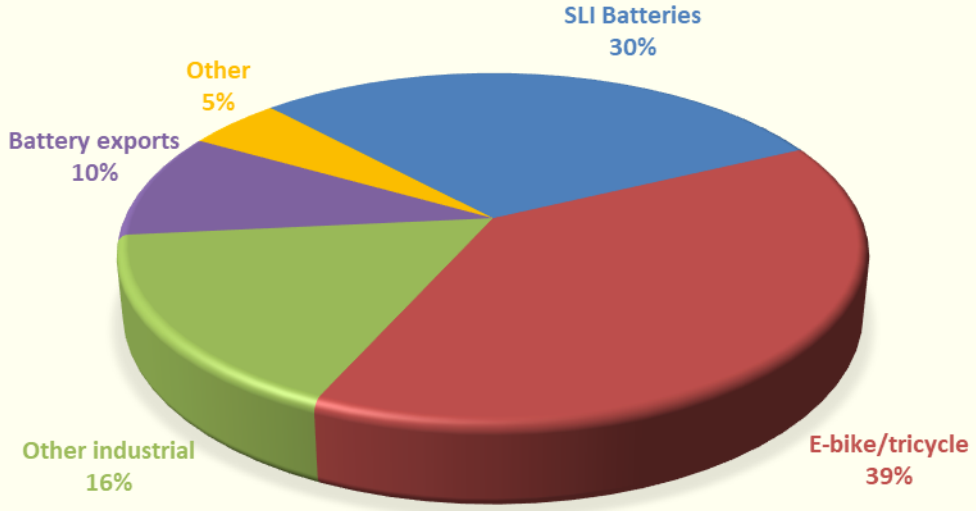
- Previous charts have highlighted the key importance of Asia to both global lead production and consumption
- CHR Metals estimates that Asian lead consumption in 2022 was a little over 9.5Mt or two-thirds of the global total
- Chinese demand alone accounted for more than two-thirds of Asian consumption
- Critical for the future of the lead industry is that, with only a few exceptions, Asian lead demand is still growing

Dynamics of the Chinese market

China's lead consumption by end-use



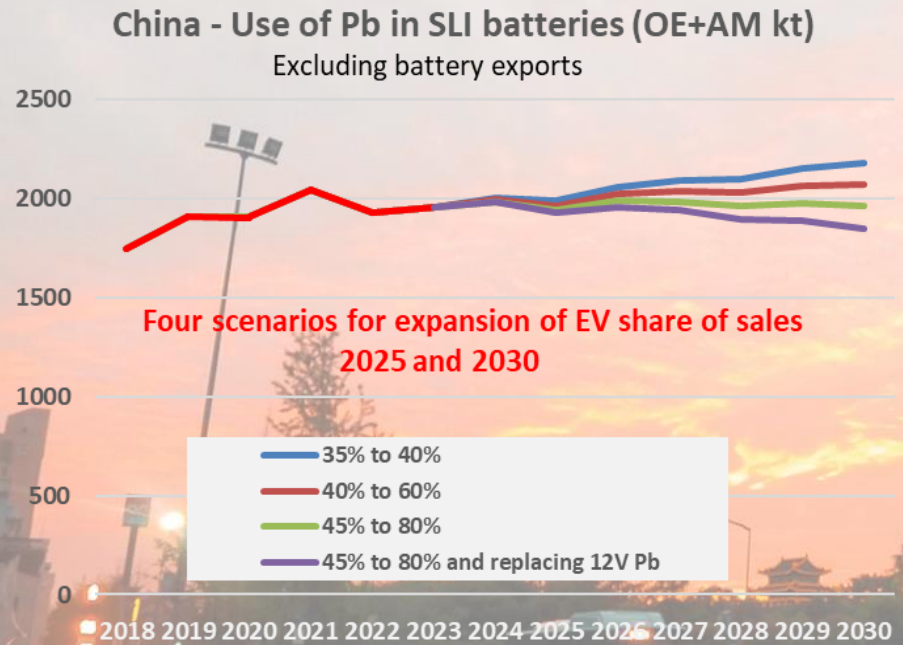
CHR Metals estimates



End-use share in 2022

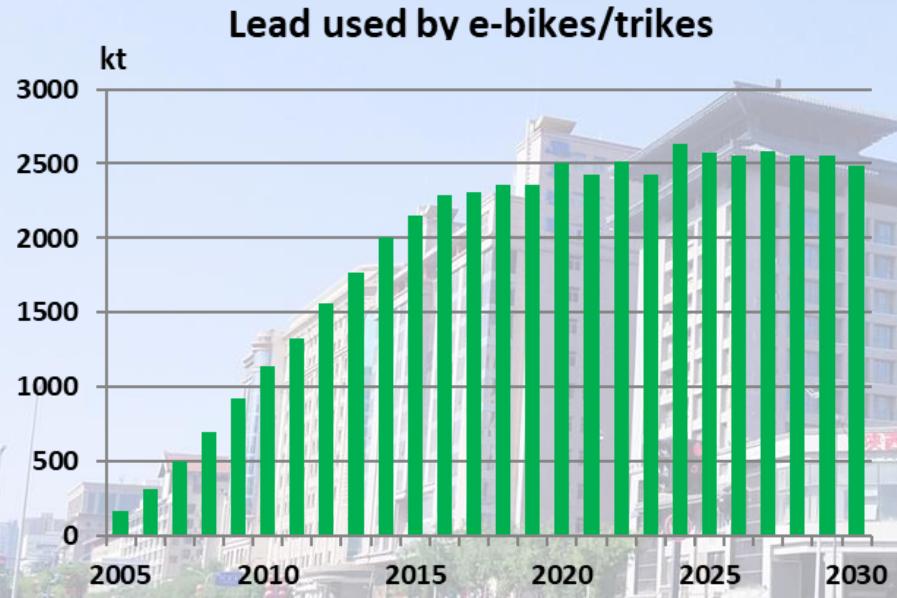
- **Pattern of China's end-use consumption of lead unlike anywhere else**

China – EVs...



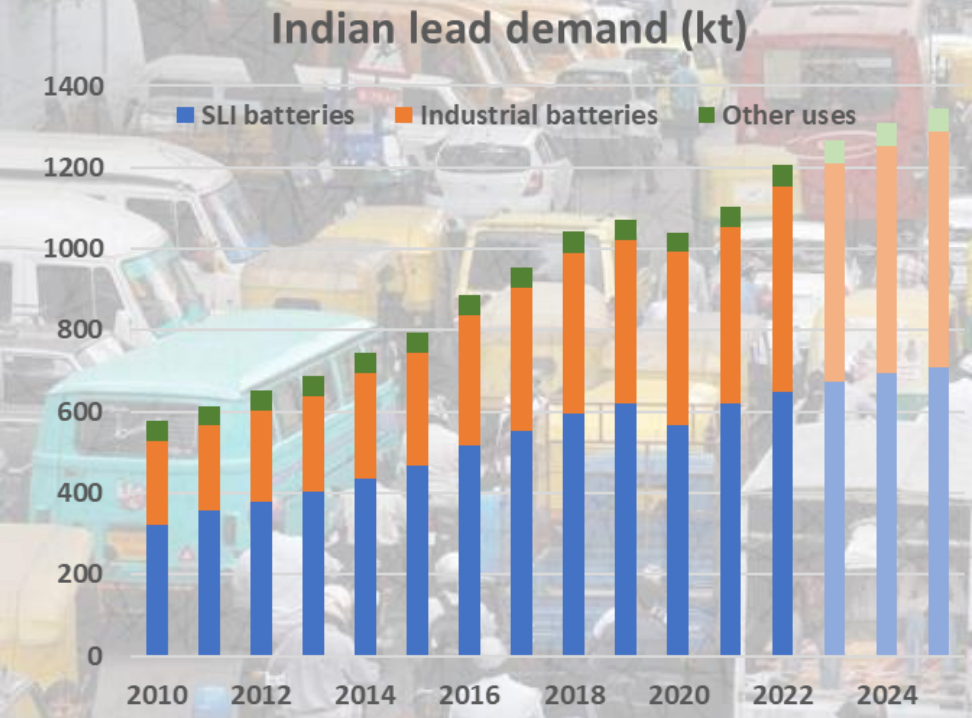
- Is Pb battery manufacture in China (and elsewhere) a sunset industry?
- It depends largely on pace of vehicle electrification
- For China, near-term outlook to 2030 shows a potential annual loss of 335kt by 2030 against base case (40% EV sales by 2030) compounded by loss of Pb battery to power 12V systems
- If Chinese EV sales less than 50% in 2030, lead use in SLI batteries, including 12V batteries in EVs, increases under CHR Metals' base case assumption

...and e-bikes



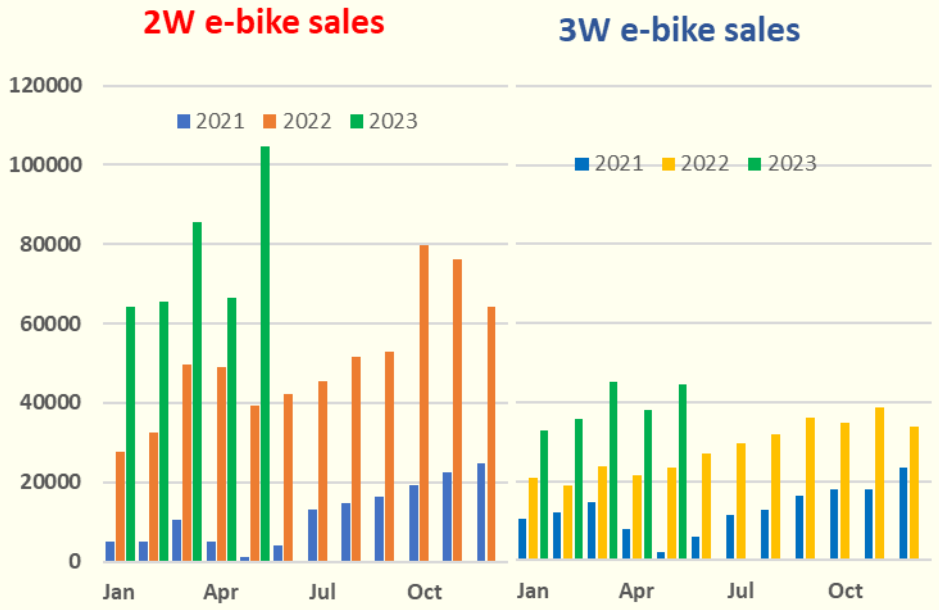
- Change in regulations and standards for e-bikes in China have not resulted in a fall in demand for lead batteries
- Surge in sales in recent years, now almost 50 million a year compared with a little over 30 million annually pre-2019
- Although some of the e-bike market has been lost to lithium batteries, this has been offset by overall growth in market size
- Situation remains fluid with variations in implementation of e-bike regulations by different local authorities
- Use of e-trikes in some cities to be curbed on grounds of safety

India - strong growth in lead demand



- In 12 years since 2010 Indian lead demand has more than doubled, increasing at almost 7% per annum
- There has been significant growth in SLI battery manufacture, but industrial batteries have seen faster growth
- For many years erratic power supplies have encouraged wide-spread use of inverters/batteries
- In the most recent years we believe that electric 3-wheelers, mainly rickshaws, have contributed to growth in demand for industrial batteries
- CHR Metals estimates that in 2022 industrial batteries accounted for 44% of India's lead used in batteries

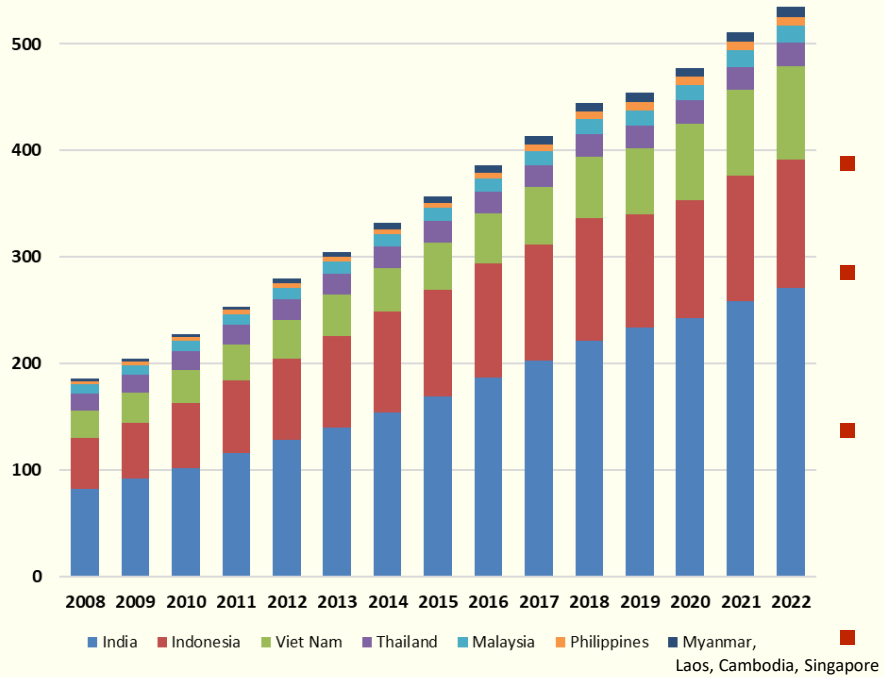
India – electric vehicles



- India has put in place policies to promote the adoption of e-mobility including 2, 3 and 4-wheel vehicles
- FAME I (Faster Adoption and Manufacturing of Electric Vehicles) from April 2015 to March 2019 provided subsidies up to 20% of the cost of vehicles – no restriction on battery technology
- FAME II from April 2019 to March 2024 – subsidy cap lifted to 40% from June 2021, with subsidy based on battery capacity
  Pb batteries excluded from FAME II subsidy
- FAME II has encouraged development of larger, faster and more expensive e-bikes than perhaps needed in push to develop local EV industry
- 2-wheel e-bike sales accounted for only 4% of total 2-wheel market in 2022
- From June 1 2023, FAME II subsidies for electric 2-wheelers cut from a maximum of 40% of the ex-works price to only 15%

Two and three-wheelers in Asia

Registered motorised two-wheelers in Asia



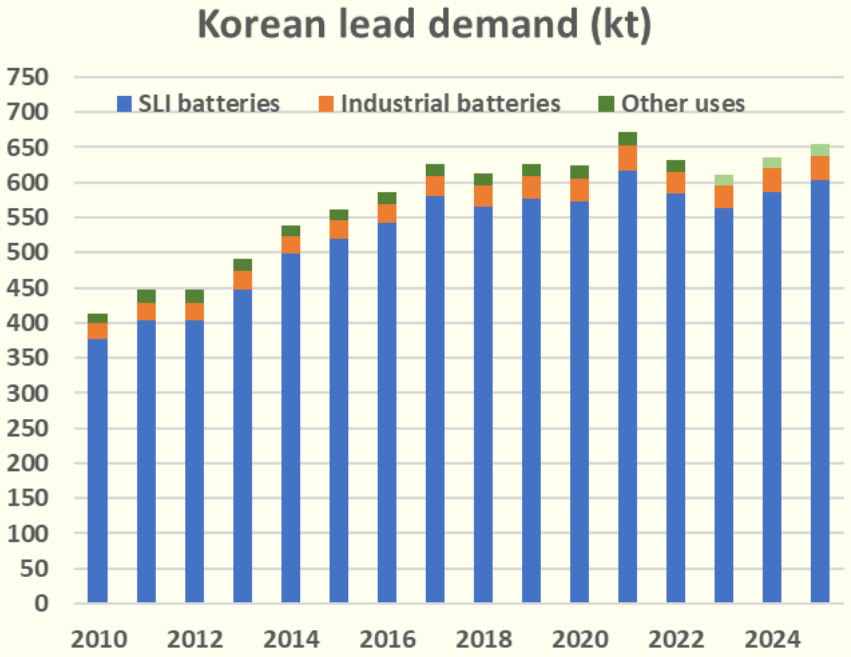
Sources: ASEANstats.org and CHR Metals estimates

- Two-wheel motorcycles and scooters and three-wheel motor rickshaws are the principal means of motorised travel in many cities in Asia
- Numbers on the road have increased significantly over the past 15 years
- Rapidly rising numbers have resulted in urban road congestion, with accompanying noise and air pollution
- Many governments in the region are now beginning to address these issues, with concerns over climate change adding urgency
- Electrifying personal mobility is one possible solution

Indonesia – 2 million e-bikes by 2025!

- E-bikes and EVs prominent in Bali for G20 meeting in November 2022
- Indonesian government has announced plan for 1 million e-bikes to be on the road by end of 2024...
- ...helped by almost US$500 million in subsidies
- Marketing of e-bikes focussed on design, speed and power although some e-bikes with lead batteries on sale in more rural areas
- Ride-hailing apps in the forefront to electrify transport for both two and three-wheelers
- Indonesian companies signing JVs with foreign manufacturers to develop local manufacturing capacity

Korea – peak lead demand in 2021?



- Lead demand in Korea dominated by SLI battery manufacture
- Around 70% of SLI batteries currently produced in Korea are exported, either in cars made in Korea or directly
- Korean battery exports facing competition from China and Vietnam
- SLI sales to domestic auto makers face attrition as Korea produces and exports more electric vehicles

Concluding comments

- Asian lead demand is forecast to grow over the next 5 years adding perhaps 750kt to annual consumption by 2028, slower rate of growth than in past 5 years
- Fastest growth is expected to be in South Asia and Vietnam
- Two battery applications have potential to offset lead demand lost through 4-wheel vehicle electrification:
  - Lead batteries will remain a much cheaper option than alternatives in powering lower speed e-bikes, and innovation is improving the performance of lead batteries. It is not too late for 2 and 3-wheel e-bikes powered by lead batteries to become mainstay of e-mobility in countries with lower incomes
    - Energy storage applications will also be key to sustaining lead demand, but currently it is very difficult to forecast how much lead might be used in these applications

C H R Metals

In-depth analysis of the global lead and zinc industries
Regular market commentary and detailed forecasts
Confidential market research assignments
Focus on Chinese lead and zinc industry developments

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