



Mind the energy gap

Is there room for 'grey' lead to play a bigger 'green' role in global decarbonisation ?

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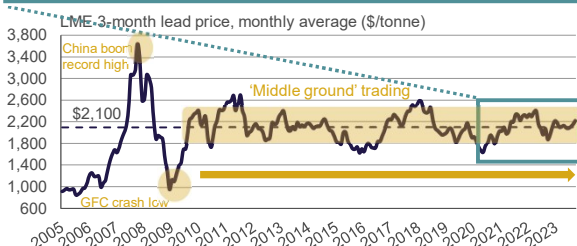
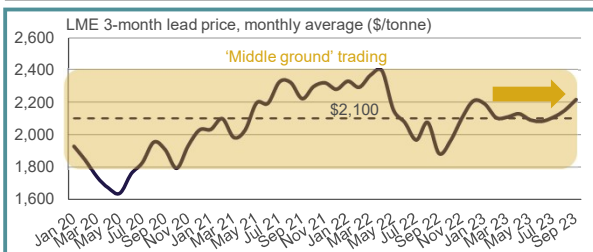
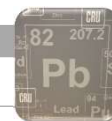
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Sideways LME lead price trading in middle of 'middle ground' range



- Pandemic exit rally from 4-year low around \$1,600 /t in spring 2020 to 4-year high in spring 2022 above \$2,500 /t. War in Ukraine fuels inflation and upside supply risk.
- Mid-2022 sell-off to 1½-year lows below \$1,900 /t. Inflation concerns switch to downside demand risk. Stronger dollar and China Covid 2022 Q2 lockdowns.
- Late 2022 rally towards \$2,300/t regains some lost ground. Lead's BCOM inclusion, tighter lead market, China ditches zero-Covid policy.
- Early 2023 slips on disappointing Covid exit China recovery, 'sticky' inflation still hurting demand elsewhere, lingering recession fears. Smelters running better as logistics/labour issues improve.
- Spring/summer settled in sideways path around \$2,100 /t, the middle of 'middle ground' trading - \$1,800-2,400 /t.
- Mostly traded in this 'middle ground' since bigger 2007-2008 swing.
- 2010-2022 average of \$2,103 /t almost right in the middle of 'middle ground' trading range.
- 2023 H1 average of \$2,117 /t also close to this midpoint.
- Squeeze on LME and SHFE behind September rally. Technical tightness rather than any tightening in physical market.

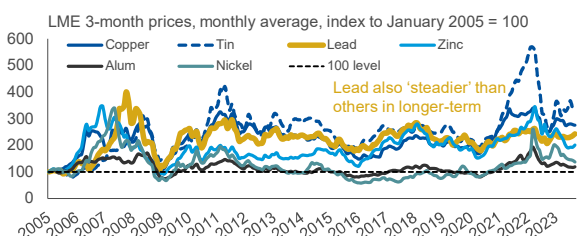
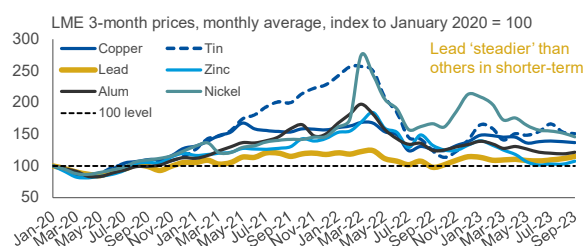
DATA: LME. NOTES: GFC = Great Financial Crisis. BCOM = Bloomberg Commodity Index. Dashed line at \$2,100 /t level.

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'Macro' drivers pull all LME metal prices around, but 'micro' lead on less volatile path



- LME metal prices tend to move in same direction on broader 'macro' drivers:
 - Mid-2020-late 2021. Uneven pandemic exit unleashed pent-up demand, but snarled up supply chains.
 - Early 2022. War in Ukraine boosted already rising inflation to fuel upside supply risk. Russian supply reliance and energy hit relevance for each metal.
 - Mid-2022. Inflation concerns switched from upside supply risk to downside demand risk. Covid lockdowns in China. Stronger US dollar on more aggressive US Fed tightening. Greater recession risk in energy-crisis hit Europe.
 - Flatter 2023 LME metals profile in more two-way US dollar path on 'sticky' inflation, lingering recession fears, slow Chinese post-Covid recovery. But also growing optimism that worst is over – "light at the end of the inflation tunnel".
- Steadier lead price path than in other LME metals due to:
 - Smaller 'closed loop' lead market imbalances than in other LME metals.
 - Economic cycle resilience of lead demand dominated by replacement auto.
 - BCOM inclusion has put lead on more investor radars, but still perception of limited energy storage role in 'green' energy transition (GET).

DATA: LME. NOTE: BCOM = Bloomberg Commodity Index



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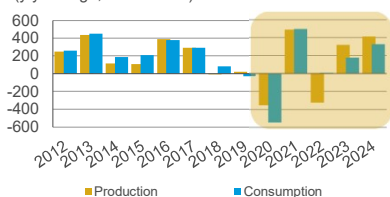
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Large lead market swings in early 2020s to lessen

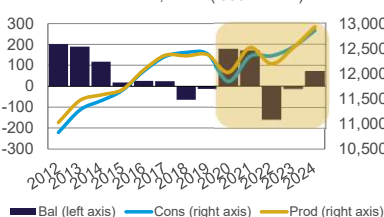
- Big Covid-19 2020-2021 swing on greater suppression of demand over supply then unleashing of both variables in pandemic exit.
- Pronounced move into deficit in 2022 on primary-led production dip while demand held up.
- Market tightness easing in 2023, as production bounces back up by more than demand.
- Modest surplus in 2024 as production growth outpaces consumption growth for second year in a row.
- As the pandemic fallout fades, lead's 'closed loop' cycle is imposing itself again in reining in the scale of market imbalances.
- Chinese arb and exports determine the degree of excess inside China and the scale of shortfall outside China.



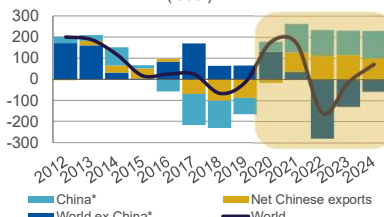
Refined lead production/consumption, world
(y/y change, '000 tonnes)



Refined lead balance, world ('000 tonnes)



Refined lead balance ('000t)



DATA: S&P Global, CRU. NOTE: * Balance excluding net Chinese exports.

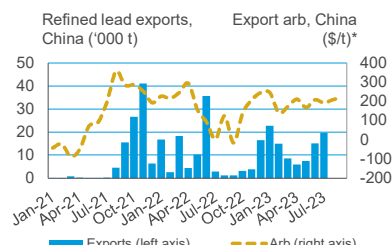
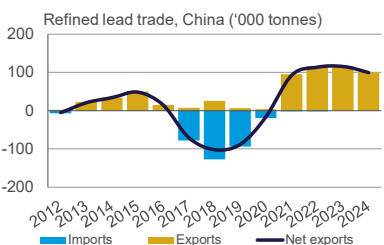
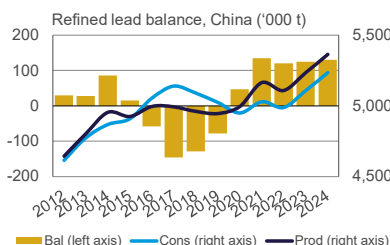
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Mind the lead glut - Chinese market surplus sticking, exports to keep flowing

- Chinese lead market switched from late 2010s deficit to early 2020s surplus on higher output and initially flatter demand.
- After production and consumption slipped in 2022, uneven recovery in 2023-2024 on ditching of Zero-Covid policy.
- Export arb window remained largely shut until opening in mid-2021 – 94kt shipped out in 2021 H2
- 2022 exports (116kt) highest since 2007 (236kt), with 59% staying in Asia, 28% shipped to the USA and 13% to Europe.
- In 2023 H1, China exported 74 kt, down 13 kt y/y, with 82% staying in Asia (53% in 2022 H1), 13% to Europe (13%) and 4% to the USA (34%).
- More Chinese lead is staying in Asia this year, with less going to the USA and Europe flat.
- USA taking more lead from other countries in this region, leaving more Chinese metal to find a more local Asian home, including LME warehouses.
- Step up in exports to continue on 'attractive enough' arb, driven by tighter US-led market outside China and easier market inside China.



DATA: S&P Global, SHFE, CRU. NOTE: *Export price (LME cash net export duty (0%), VAT (13%) and VAT rebate (0%)) minus SHFE cash price.

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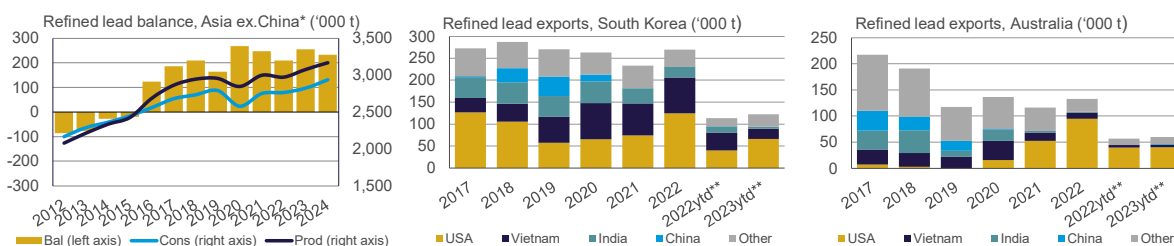


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Persistent Asian market surplus outside China too



- Already sizeable surplus in Asia excluding China is stepping up again in 2023 on bigger lift in production over consumption.
- Korea (mainly, but not exclusively KZ's Onsan) and Australia (Trafigura's Port Pirie) helping to plug the supply gaps in other regions, notably the USA.
- Having lifted to account for one third of all Korean exports last year, the percentage going to the USA rose to over half in 2023 H1, with flows down to many Asian destinations, including Vietnam, Indonesia, India and Thailand.
- While lower output at Port Pirie is behind the step down in Australian exports, shipments to the USA have picked up in recent years as new Port Pirie owner Trafigura looks to ship more metal there. Of the 60 kt exported in 2023 H1, two-thirds (40kt) went to the USA, a similar tonnage to 2022 H1.
- Both countries are no longer shipping to China due to the closure of the import arb and the opening of the export arb.



DATA: S&P Global, CRU. NOTES: * Asia excluding China, including Australia and New Zealand. ** Year-to-date (ytd) to June.

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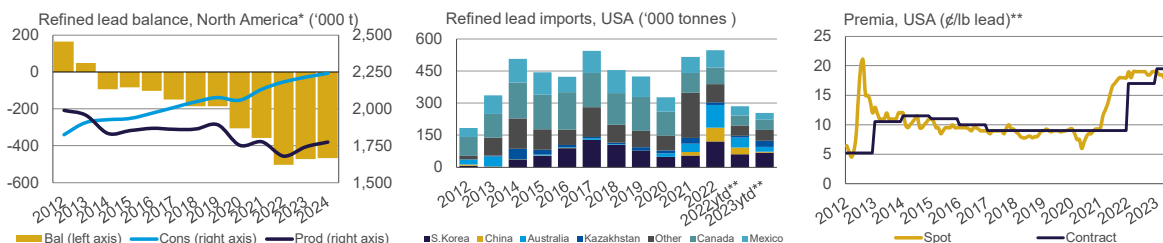


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Mind the lead gap - North America running a larger deficit in early 2020s



- North American lead market flipped into deficit on closure of Doe Run's Herculanum smelter at the end of 2013.
- Widening gap on mostly rising demand but more steps down in output in early 2020s – Belledune (end-2019), Covid-19 (2020), Florence (2021), labour-led constraints (2022). Big premia hike to attract higher imports to fill the wider local supply gap.
- US imports up another 10% in 2022, just shy of 2017 record high. Main inflows from Asia, notably Australia, Korea and China.
- Contract premia more than doubled from 2021 to 2023. Echoes of last big 'more than doubling' jump from 2012 to 2014 on Herculanum exit.
- Only small shrink in still sizeable regional deficit in 2023-2024 on better smelter performances, with demand growth slowing from strong 2021-2022 gains.
- US spot premia slipped through 2023 Q2 to around 15 ¢/lb, down 3-4 ¢/lb from 2023 Q1 levels. US imports down by around 50 kt y/y to 226 kt in 2023 H1.
- However, imports and premia need to stay relatively high to fill the local supply gap. So limited premia downside ahead in regional market where tolling is king.



DATA: S&P Global, CRU. NOTES: * USA, Canada and Mexico. ** Year-to-date (ytd) to June. *** Secondary lead, delivered mid-west USA basis.

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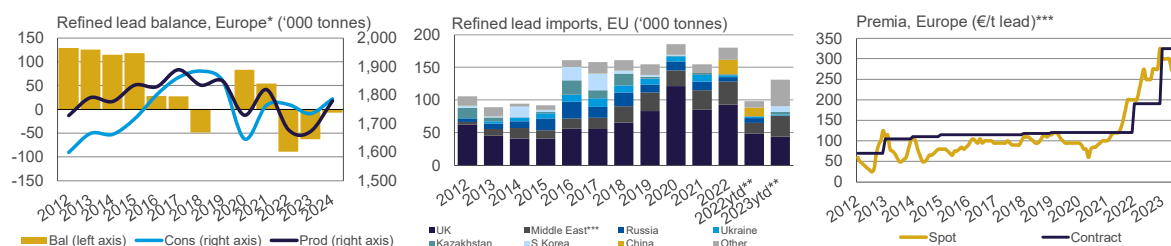


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Easing in European tightness

- European lead deficit last year driven by big fall in output (Stolberg absence, Ecobat Italian smelter shuts), despite flat demand after strong 2021 gains.
- Higher EU imports in 2022 led by the UK, but also the first notable shipments from China since 2007. 2022 imports just below 2020 high.
- 'Triple-digit' y/y jump in 2023 contract premia a bigger step up than 'double-digit' 2022 rise, reflecting higher energy-led smelter costs and lack of local metal.
- Despite demand slip, only modest reduction in 2023 deficit due to flat rather than rising output. Stolberg return offset by Porto Vesme closure and extended Plovdiv smelter shut (refinery still processing custom bullion feed, if at reduced rate).
- Spot falling below contract premia is indicative of a less tight market. Further market easing next year on greater rebound in production than consumption. Suggests downward premia pressure in 2024 contract talks ahead. Nowhere to hide for smelters – tough task to defend previous premia hikes.
- EU imports up 47 kt y/y to 145 kt in 2023 H1 to highest first half since 2004. Led by the UK, but more from Asia. Premia still high enough to attract more imports.



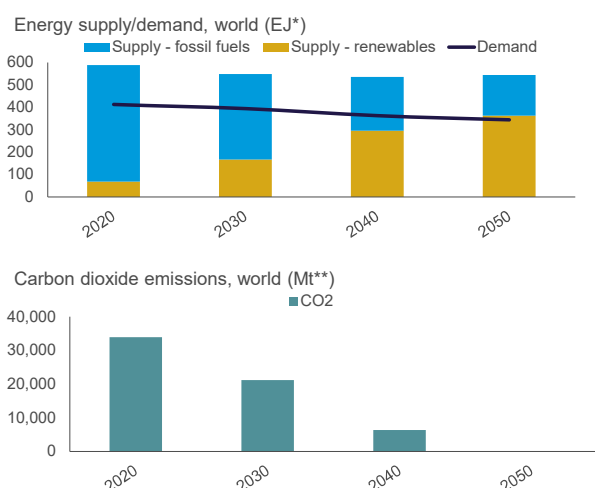
DATA: S&P Global, CRU. NOTES: * Excludes Russia. ** Year-to-date (ytd) to June. *** Basis is ex-works mainland Europe for secondary lead.

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IEA Roadmap shows how global energy sector can reach net zero by 2050



- Mind the energy gap. Gap between government pledges and action needs to close to have chance of reaching net zero emissions by 2050.
- Closing the gap requires nothing short of a total transformation of the energy systems that power the global economy. Is there the political will?
- Need to change energy supplies to be dominated by renewables rather than by fossil fuels in order to reduce CO₂ emissions to zero by 2050.
- IEA Roadmap shows there is still a way to reach net zero by 2050 using most technically feasible, cost-effective and socially acceptable path.
- Huge challenge to move from this narrow possible pathway to practical reality.
- CO₂ emissions rebounding sharply from the Covid-19 dip as economies recover, so now is the time to act to accelerate the 'green' energy transition (GET).



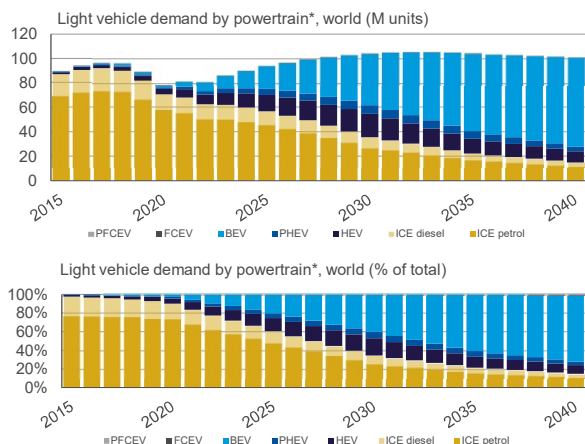
DATA: International Energy Agency (IEA) – "Net Zero by 2050 – A Roadmap for the Global Energy Sector" (May 2021). NOTES: * Exajoules, ** Million tonnes.

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New auto lead batteries still have role to play in 'green' energy storage transition



* ICE = Internal Combustion Engine vehicle, including micro 'stop-start' HEVs. HEV = Hybrid Electric Vehicle, PHEV = Plug-in HEV, BEV (EV) = Battery-powered Electric Vehicle, FCEV = Fuel-Cell Electric Vehicle, PFCEV = Plug-in Fuel-Cell EV, NEV = New Energy Vehicle.
Data from CRU vehicle model for light-duty vehicles.

DATA: CRU.

- Vehicle electrification transition from ICE to NEVs firmly embedded in automotive world.
- CRU still sees late 2020s tipping point where ICE share slips below 50%. ICE share falling from 90% in 2020 to 34% in 2030, 15% in 2040.
- Rapid rise in NEVs led by BEVs also means rapid rise in OE lithium auto battery demand.
- But only modest impact on OE lead auto battery demand growth, at least through 2020s and likely beyond.
- Low voltage (12V) lead-based battery use to continue for starter and auxiliary functions across the vehicle powertrains.
- Some car makers are using 12V lithium batteries (e.g. Hyundai, BYD), but others could be slow to follow for cost and safety reasons.
- ICE ban deadlines ahead could slip or rules eased as the reality of switching takes hold. For example, the readiness of 'green' energy supply and EV charging infrastructure. No transition without transmission.
- Outside light vehicle automotive sector, growth opportunities for lead batteries in micro-mobility (e-bikes, e-scooters, e-rickshaws etc), particularly in developing countries.

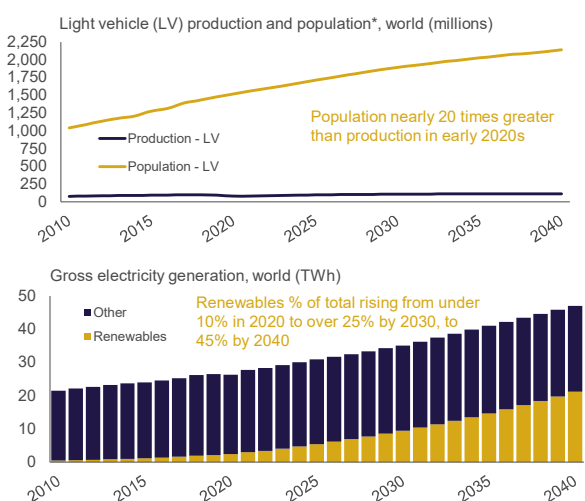


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Long tail of replacement auto lead batteries, more mixed industrial tale



DATA: CRU. NOTE: * Replacement and OE auto battery demand driven by vehicle population and production respectively.

- Population trumps production. Vehicle population hugely outstrips vehicle production, so replacing existing batteries on the road far more important lead demand driver than the OE side, if moderating through time.
- Lead battery typically replaced 2-3 times in a LV's 10-15-year lifetime.
- Long tail of replacement auto lead battery demand stretching decades rather than years beyond ICE ban deadlines ahead.
- More frequent extreme weather events – hotter, longer summers, if milder winters. Less seasonal, more year-round battery stocking.
- As 'clean energy' renewables contribution to power grids grows, big opportunity for cheaper, 'good enough' lead batteries to gain market share in reserve power Energy Storage Systems (ESS) amid surging lithium battery use.
- EV fast charge buffering and behind-the-metre/back up power (residential and small business) are two key areas of opportunity.
- Lithium batteries continue to take share away from lead batteries in industrial (fork-lift) trucks and e-bikes on motive power side and in UPS (data centres) on reserve power side.
- Less marked move to lithium batteries in telecoms as a high-temperature tolerance trend favours lead batteries.



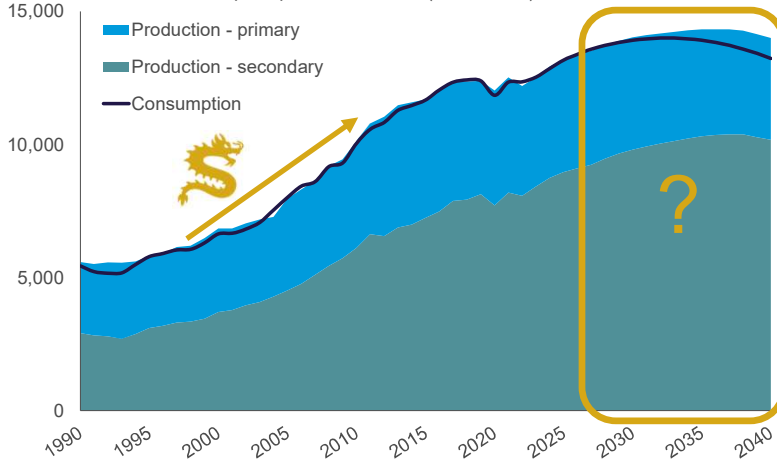
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Slower demand could result in structural surplus ☹️

Refined lead consumption/production, world ('000 tonnes)



DATA: CRU.

- Chasing the new dragon. Chinese demand boom is long over and battery metal lead struggling to find a bigger role in 'green' energy transition (GET).
- Likely that there will be some degree of slower automotive lead battery demand ahead. Industrial battery outlook could go either way.
- Sliding rather than slower growth in lead demand could ultimately result in more persistent over-supply:
 - Scrap generated from lead batteries will keep on coming for a long time; and continue to be recycled, at least for a while.
 - On the primary supply side, lead will continue to be mined alongside zinc and silver.
 - Lead concentrate surplus persists, although lead mine output is down from mid-2010s record high, reflecting move to more 'zinc-rich' and 'lead-poor' mining trend.

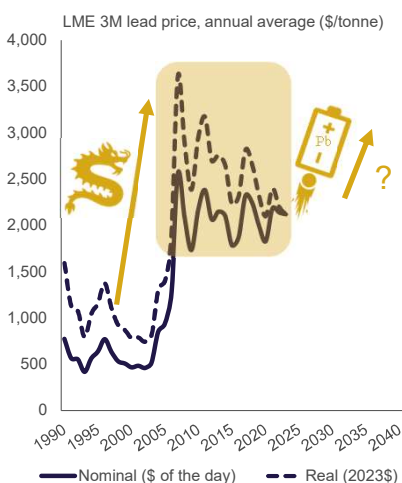


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Can resilient lead re-energise and break again to the upside ? 😊



DATA: LME. NOTE: GET = Green Energy Transition.

- No big step change yet in 'micro' lead imbalances. Importance of 'closed loop' cycle.
- No compelling bullish lead demand 'micro' narrative yet to banish bearish oversupply concerns.
- No break-out in longer-term 'sideways' (nominal) or 'slipping' (real) lead price path.
- Lukewarm investor attitude to battery metal lead's role in GET is limiting price upside.
- Investors more excited by 'hotter' demand outlook for 'greener' metals like copper and other battery metals lithium, nickel, cobalt and manganese.
- This attitude towards lead is somewhat misplaced.
- Lead needs to be part of the multi-battery energy storage solution rather than being seen as part of the problem.
- Strong 'cradle-to-grave' lead credentials - widespread geographical and abundant supplies, more recycling, less mining and safer, cheaper, always improving battery performance (e.g. bipolar).
- Compared to weaker 'cradle-to-grave' lithium credentials - potential inter-regional bottlenecks, mainly mined, immature recycling, less safe (flammable) and costlier batteries. Solid-state lithium and sodium-ion could address shortcomings.
- Time for battery metal lead to GET going. Re-energise its resilience in existing uses and make tangible gains in new 'greener' uses too.
- Turn lead's story more and more into one of evolution within rather than outside the 'green' revolution underway.
- Lead batteries need to play a larger not a smaller role in minding that the 'green' energy gap does not yawn too wide if lithium batteries alone are seen as the only solution.

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Thanks for listening – any questions ?

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