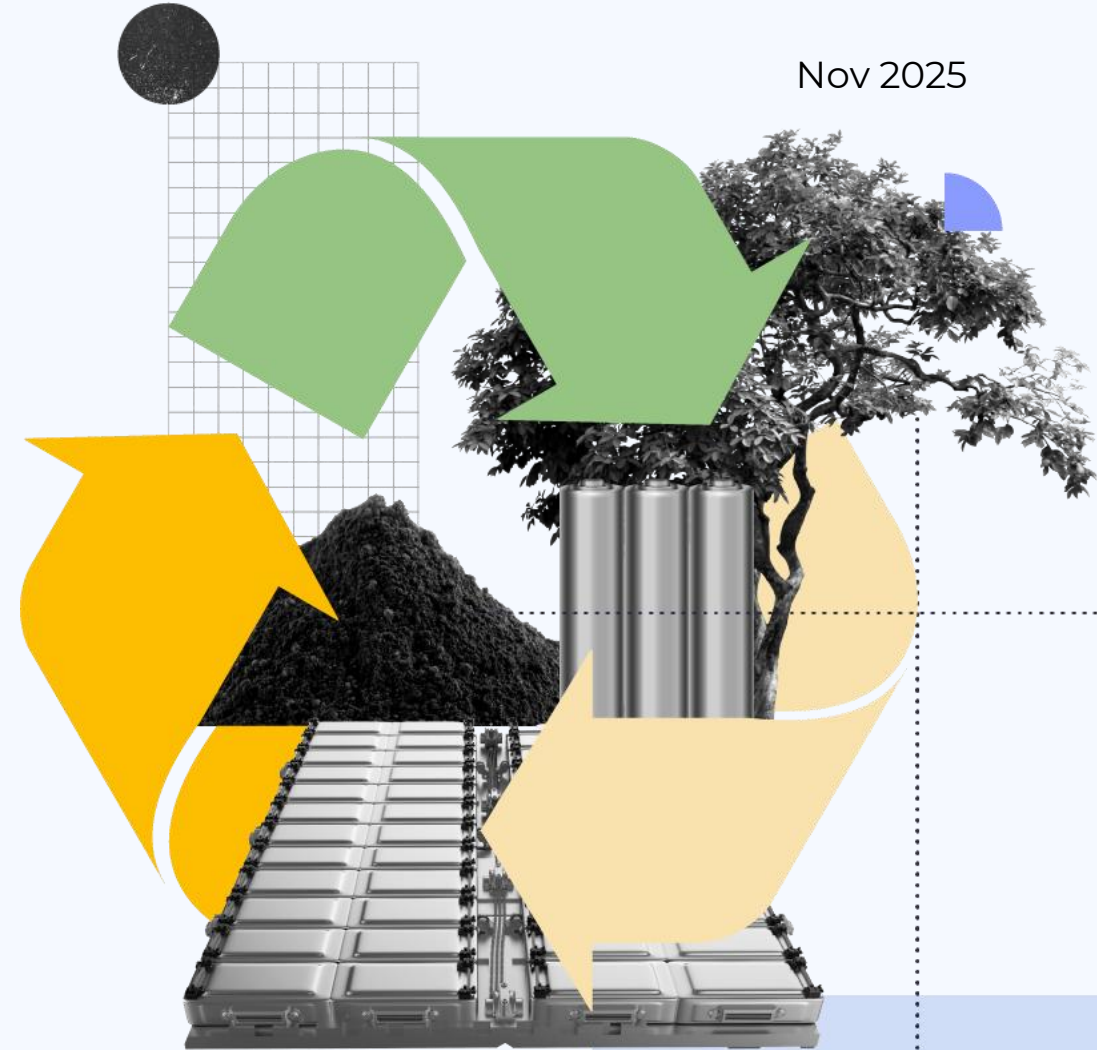


Battery recycling in Europe: Challenges and Opportunities

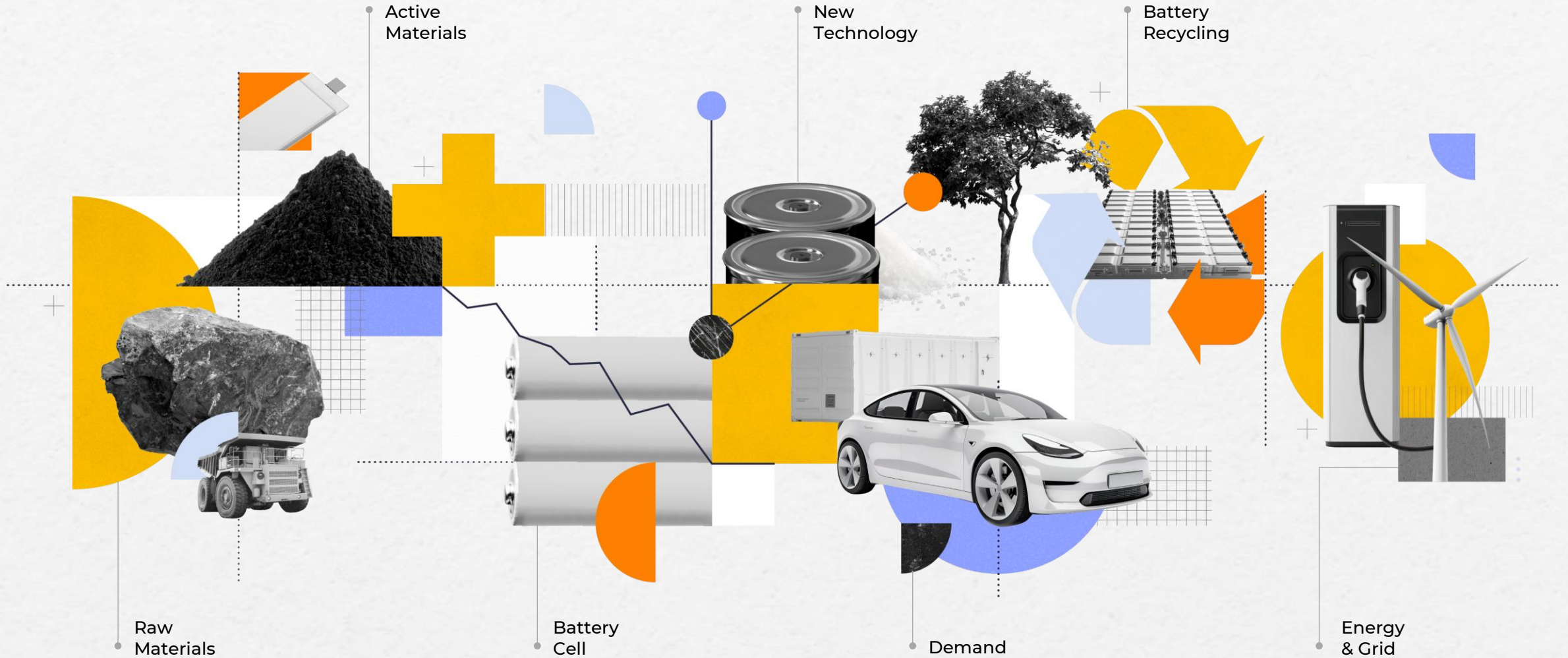
Hungarian Battery Days

Jie(Jessie) Xu
Senior Research Analyst
Benchmark Mineral Intelligence/Rho Motion

benchmarkminerals.com

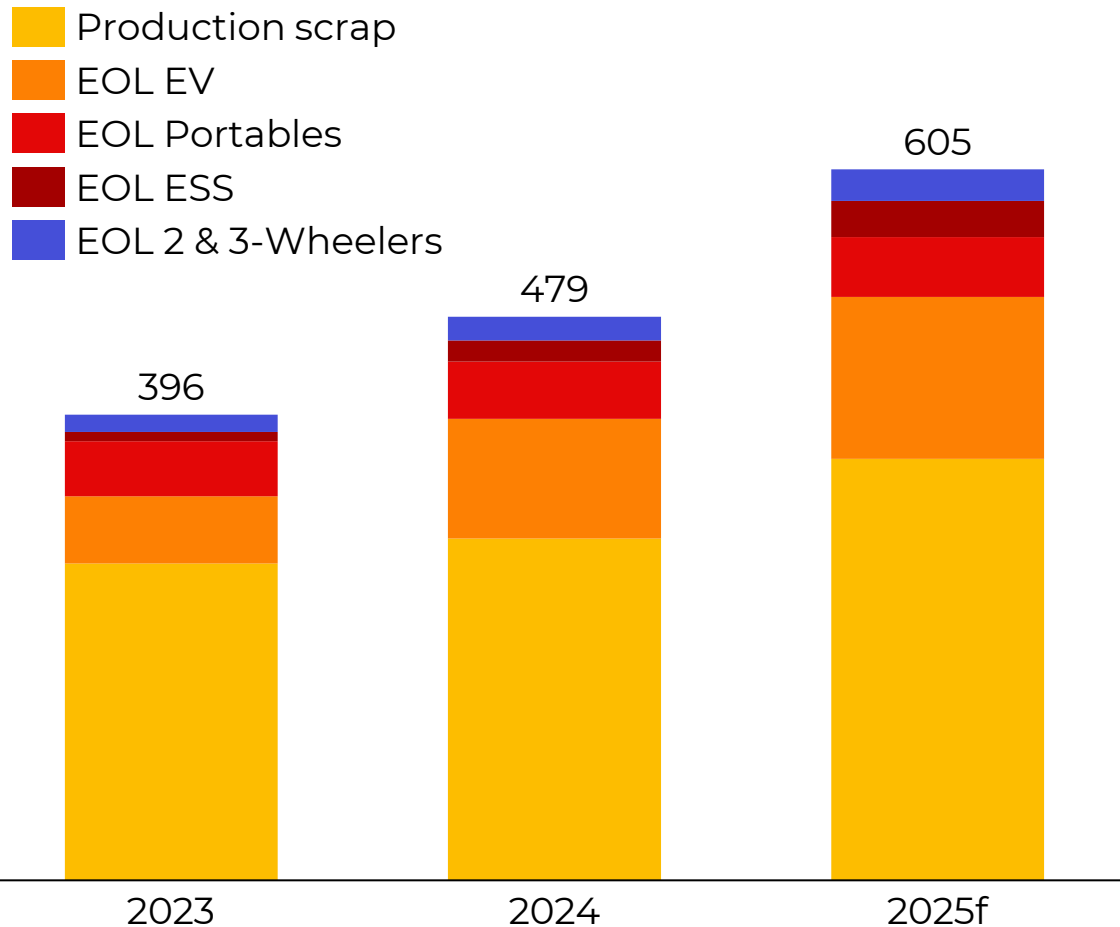


Mine to Grid Coverage



Recycling scrap available to grow to over 600k tonnes in 2025

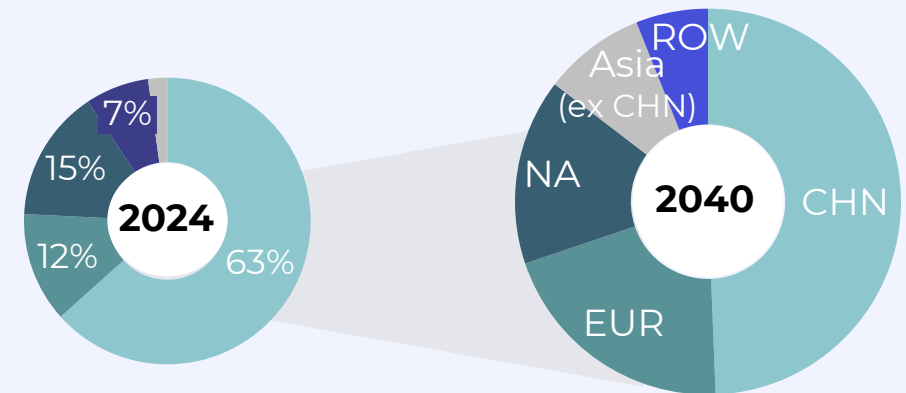
Global annual black mass available, '000 tonnes



2025 main feedstock by region

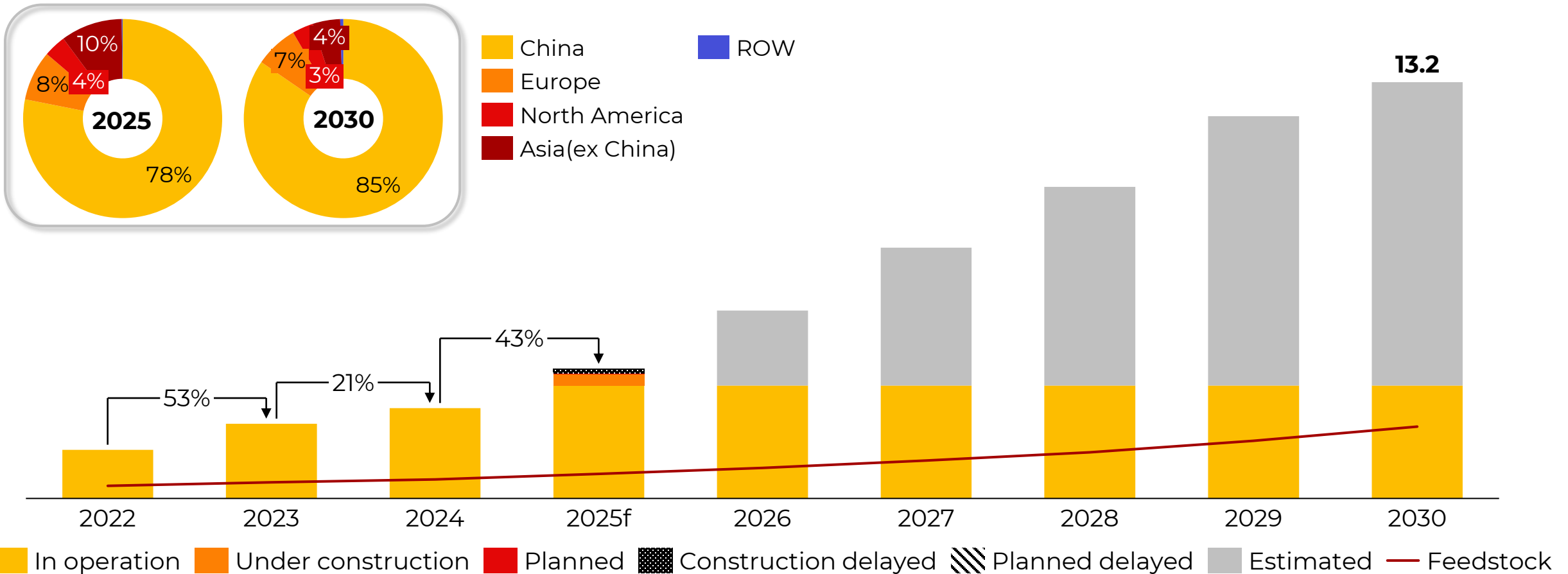


Regional share



Annual pre-treatment continued the growth in 2025 with China is expected to be the largest contributor by 2030

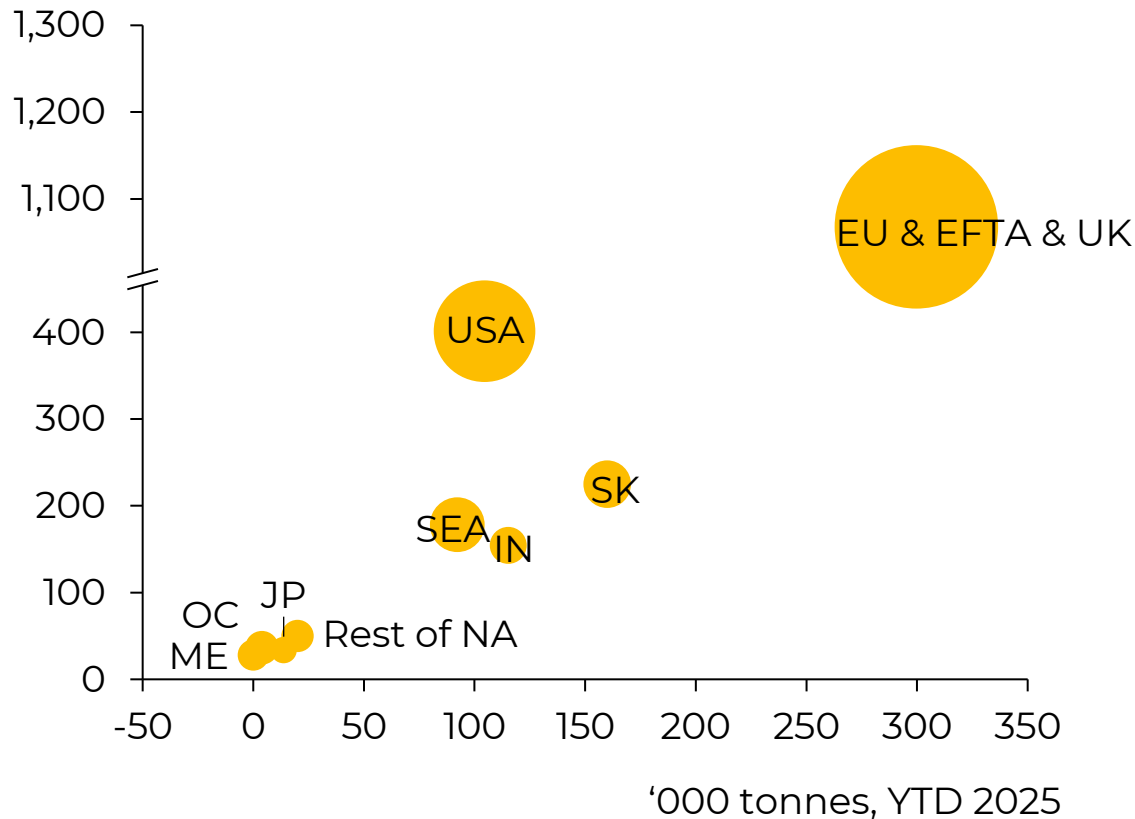
Global annual pre-treatment capacity by plant status, million tonnes



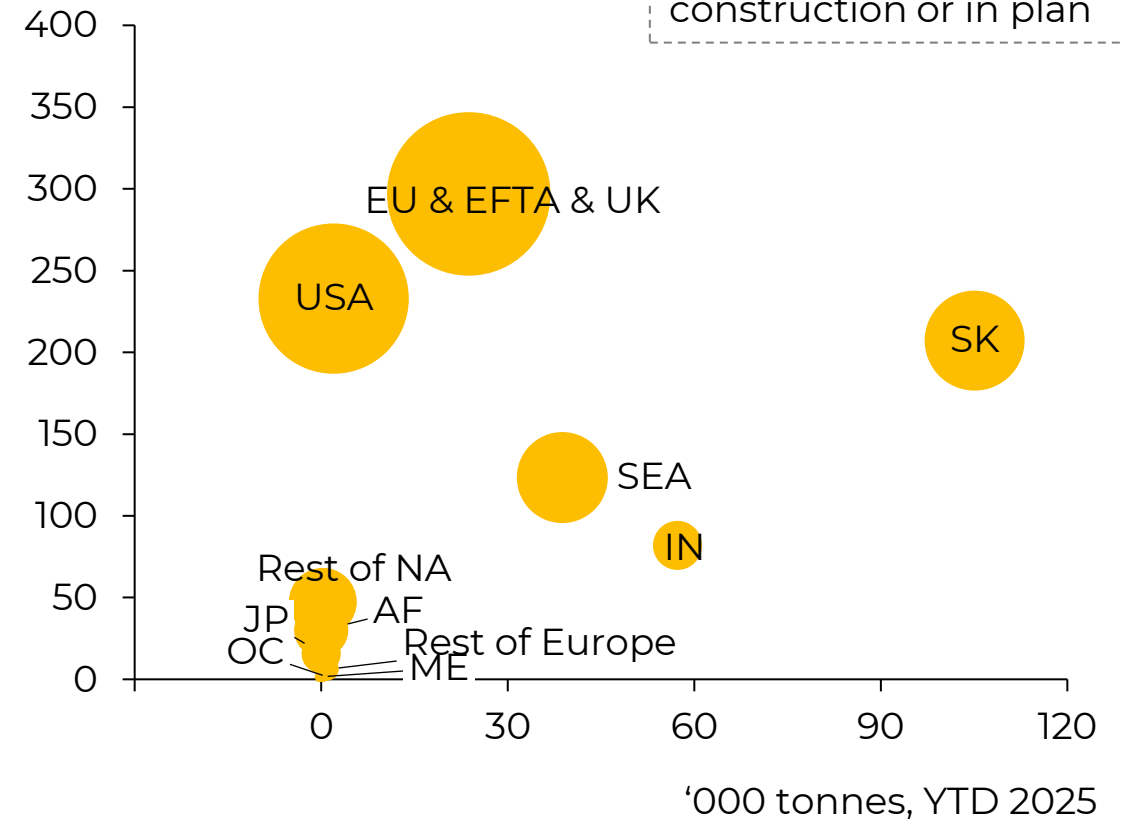
Outside China, EU & EFTA & UK is expected to see the largest capacity expansion in the long term

Regional battery recycling capacity developments, excl China

'000 tonnes, 2035



'000 black mass tonnes, 2035



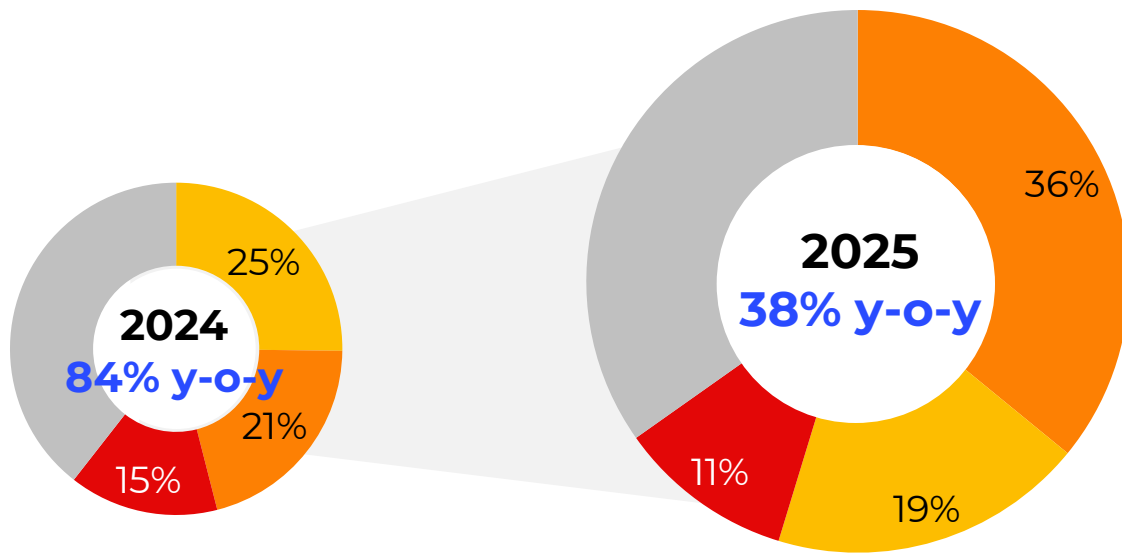
Size of bubble represents plant capacity under construction or in plan

Regions with no planned expansions are not shown in the charts

South Korea (SK), India (IN), Oceania (OC), Middle East (ME), Japan (JP), Southeast Asia (SEA), Africa (AF), North America (NA)

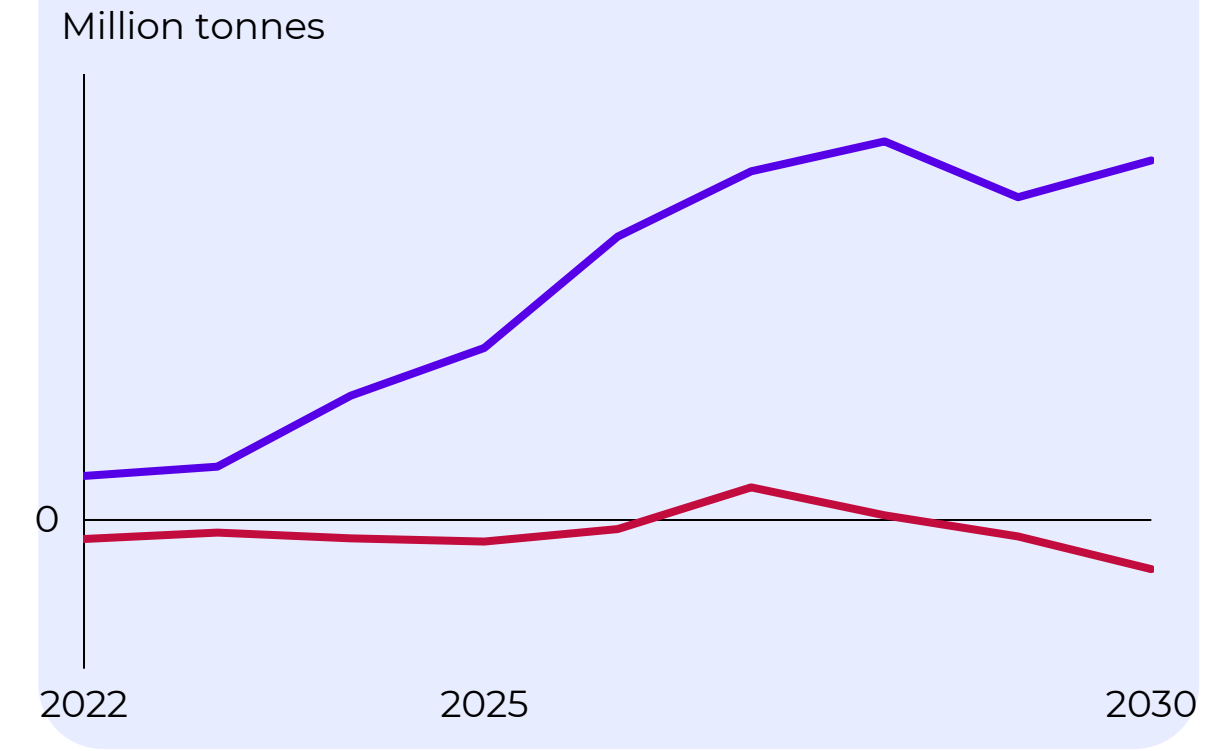
Slower growth in Europe in 2025 on pre-treatment amid market challenges while refining remains insufficient

Europe's annual pre-treatment capacity by country



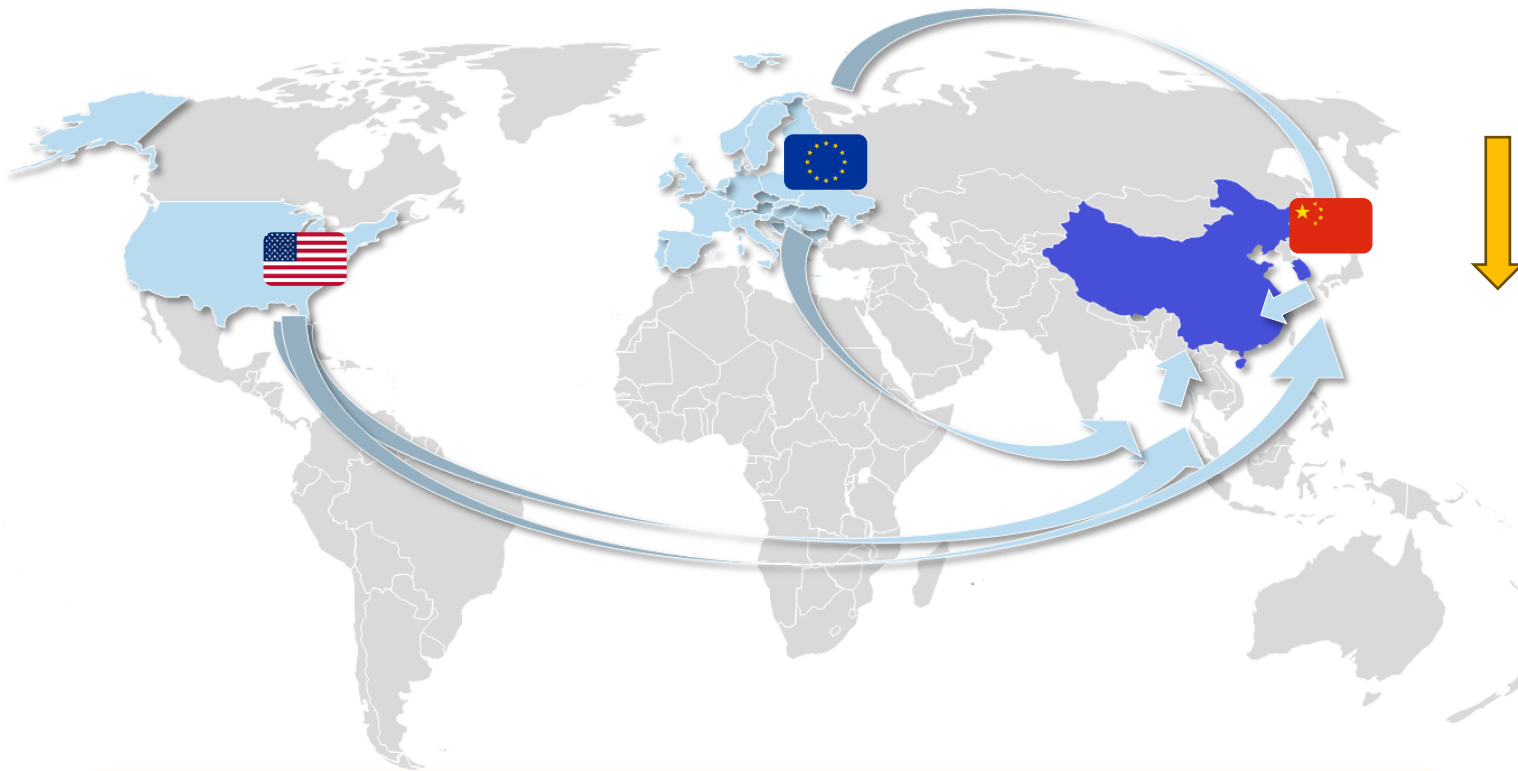
Poland Germany Hungary Others

Recycling capacity and scrap balance, 2022-2030



Refining capacity balance Pre-treatment capacity balance

China opens the door for black mass import, with more high-quality black mass expected to be imported



Impurity



Heavy Metals (Cr, As, Pb, and Cd)

Fluorine content

Acid-insolubility

Al/Cu

Where the black mass ends with



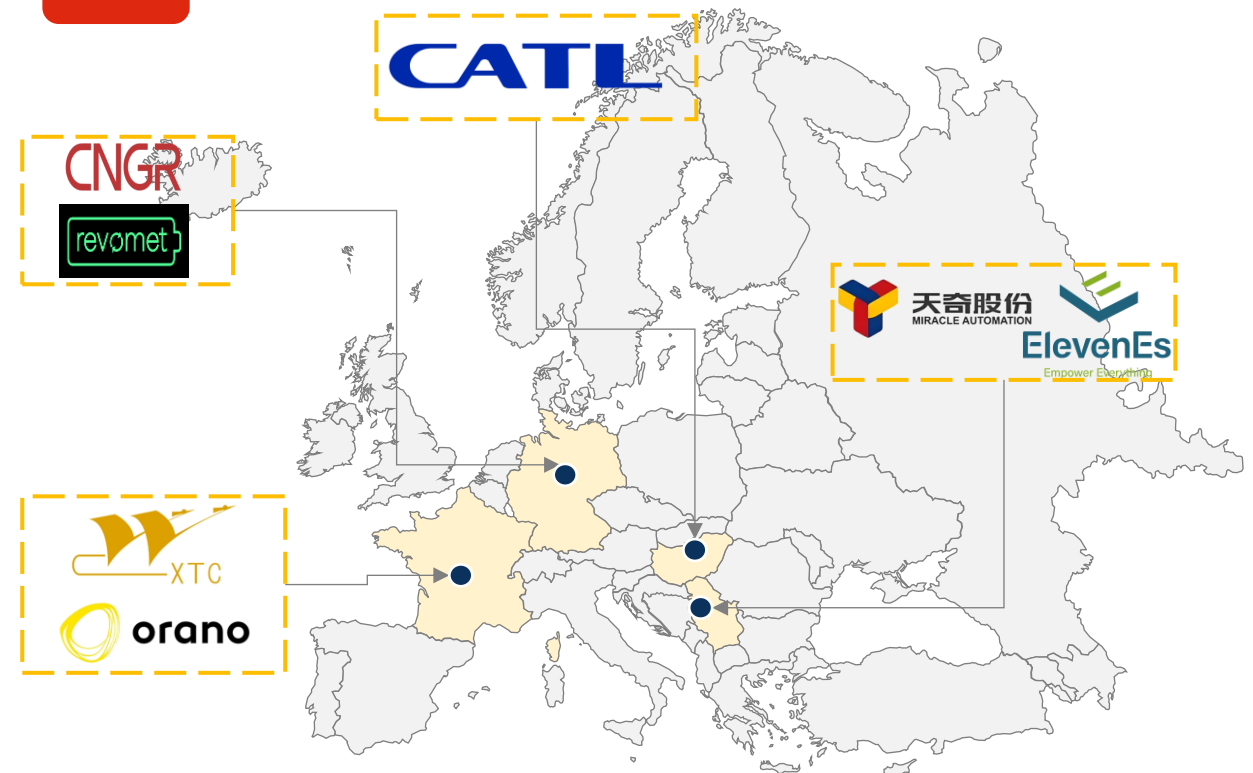
This is a non-exhaustive representation as of September 2025

Chinese recyclers are entering Europe via partnership to close the loop between Europe & Asia amid impact from EWC



Black mass is now hazardous waste

- Product-classified material has been reclassified in some cases
- MHP production explored to evade hazardous waste export restrictions
- Uncertainty around intermediates despite recycling efficiency rules
- Buyers looking to EOL batteries and cathode foil



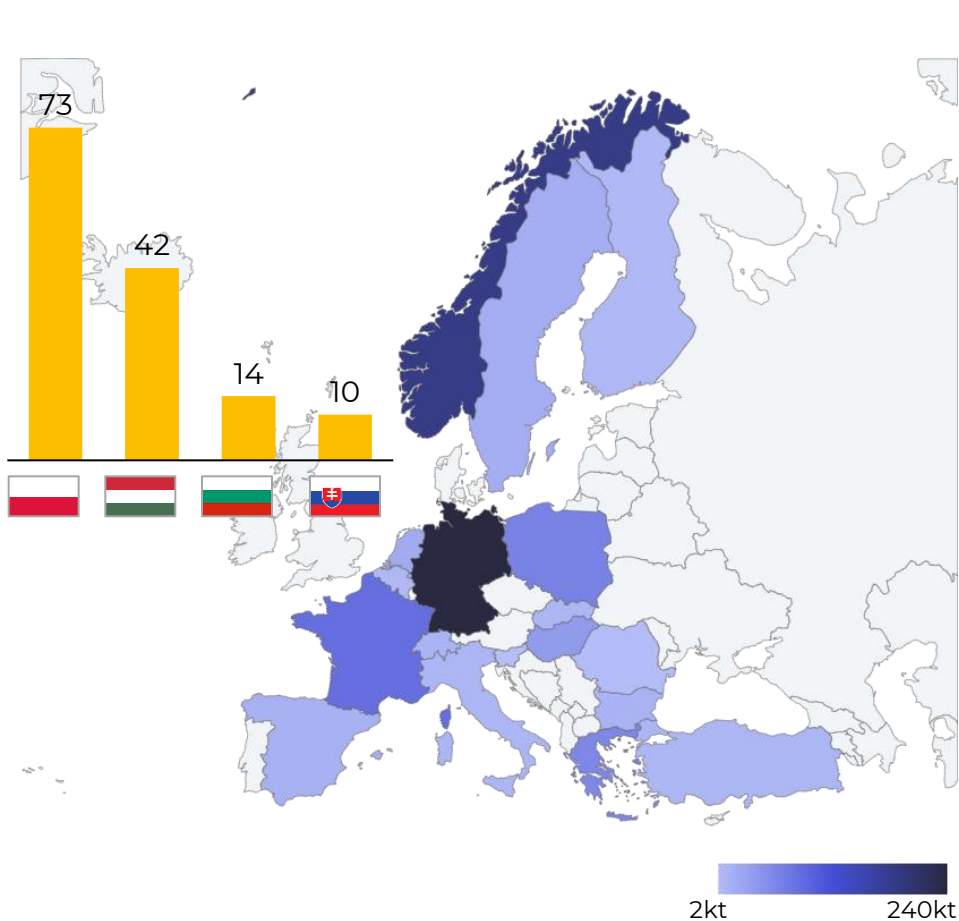
Locations under consideration:



This is a non-exhaustive representation as of September 2025

Will East/Central Europe be the hub of battery recycling for Europe?

2030 annual pre-treatment capacity by country, '000 tonnes



Feedstock



Capitals



Refining capability



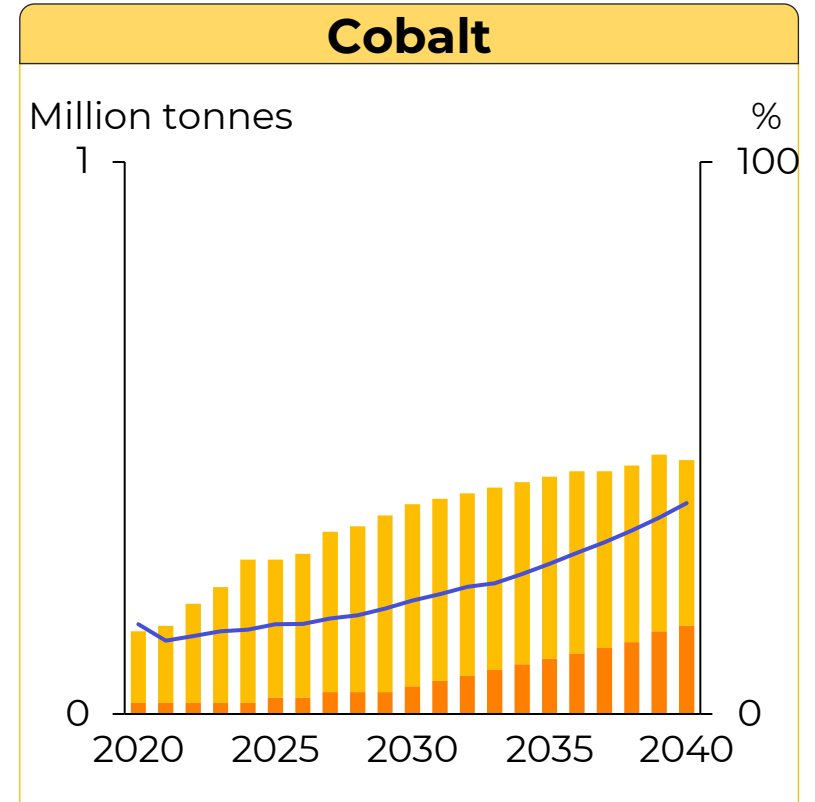
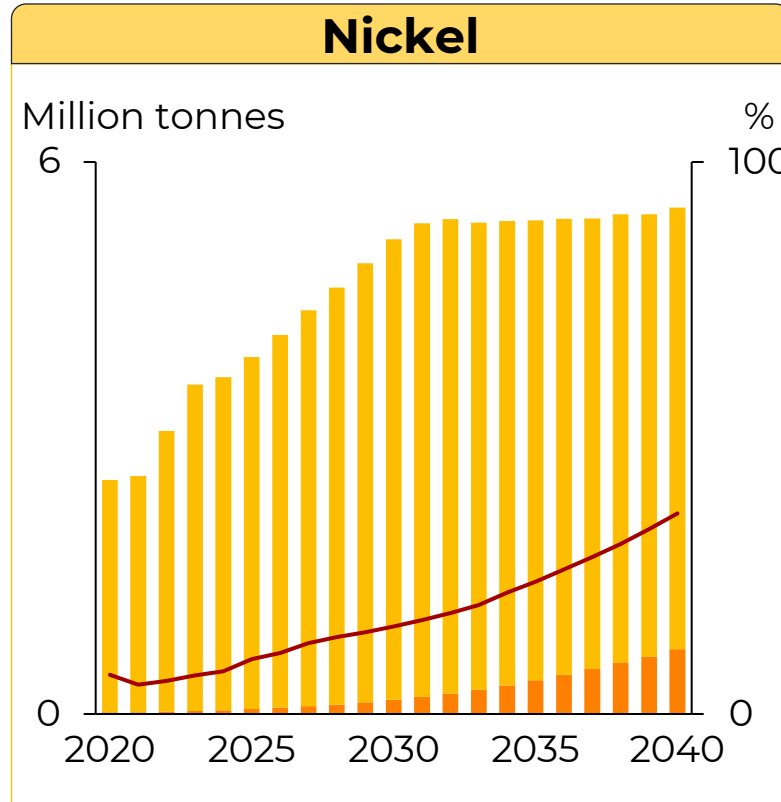
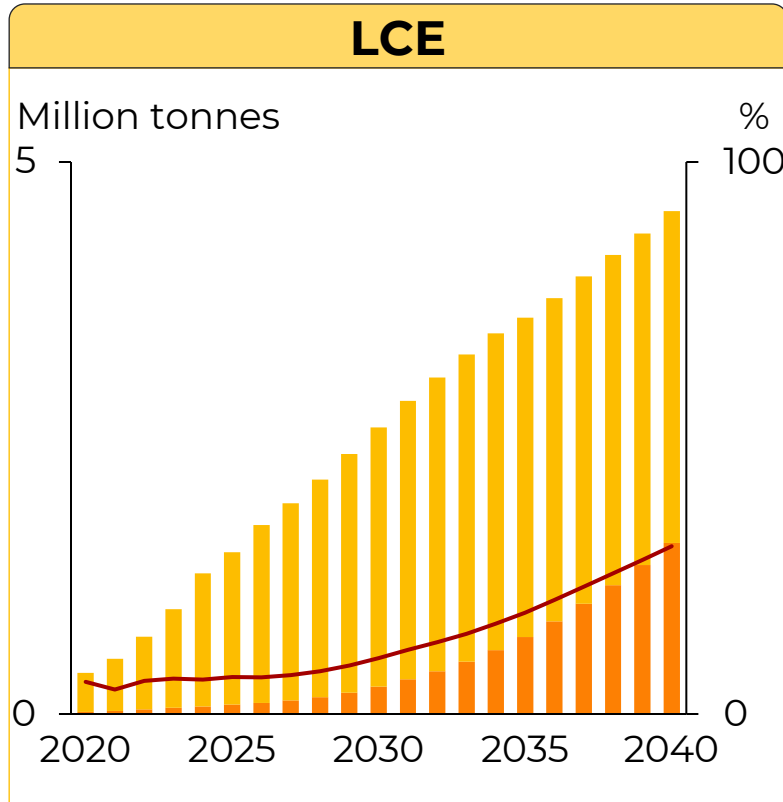
Legislation



Support of midstream buildout

Secondary supply expected to contribute over one-third of total material supply in the long term


Metal demand & secondary supply versus demand, 2020-2040




■ Mined Supply
 ■ Recycled Supply
 — Recycled supply as a % of battery demand

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