



The highest bidder get the batteries

How reuse and battery production is critical for sourcing end-of-life batteries and why China is leading in half time

Hans Eric Melin
Circular Energy Storage

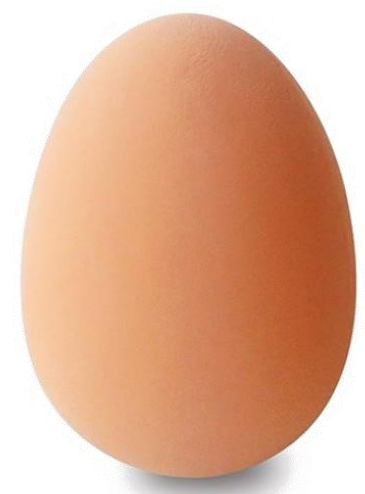


Circular Energy Storage

- London-based consultancy focused on lifecycle management of lithium-ion batteries
- Data on battery volumes (POM, EOL, 2nd life, recycling), prices, players and research through subscription services
- Consulting services for companies in the battery, energy storage, automotive and raw material industries as well as governments and organisations



Who came first?

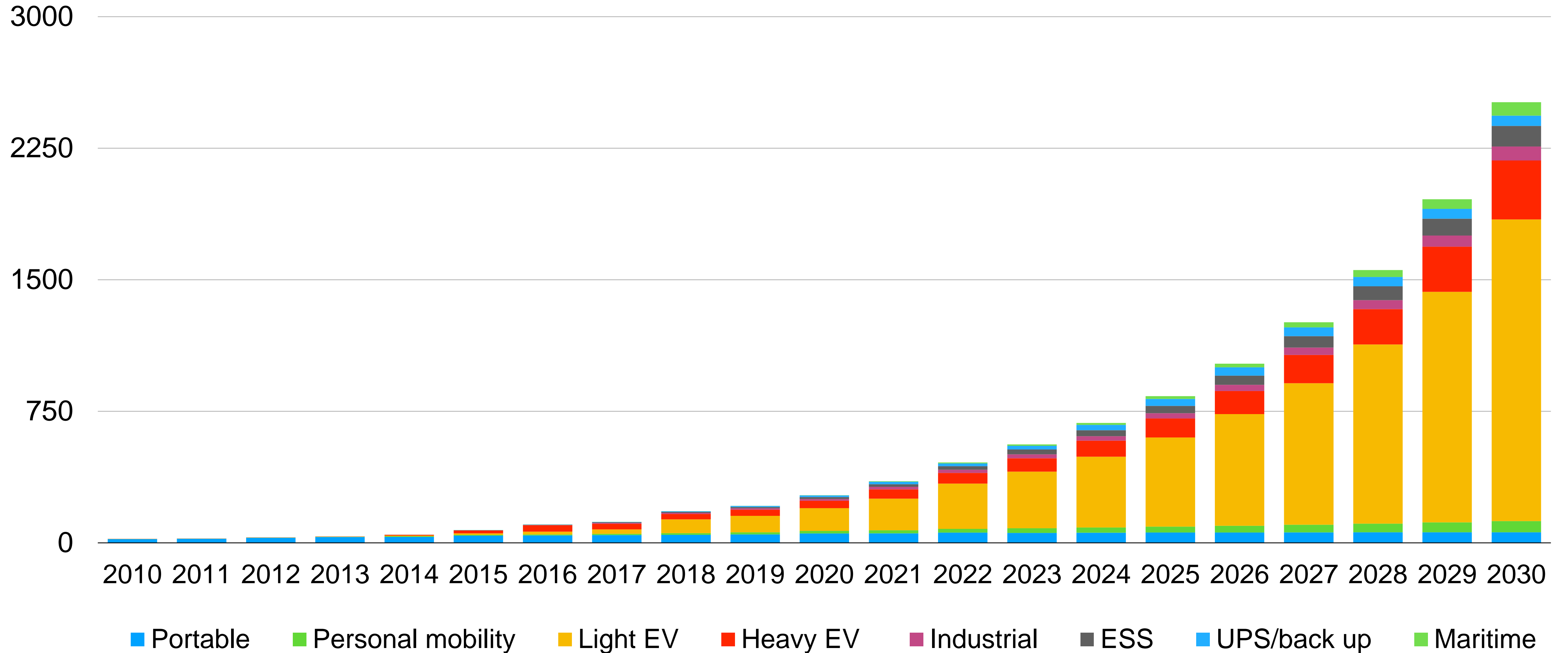


Who came first?



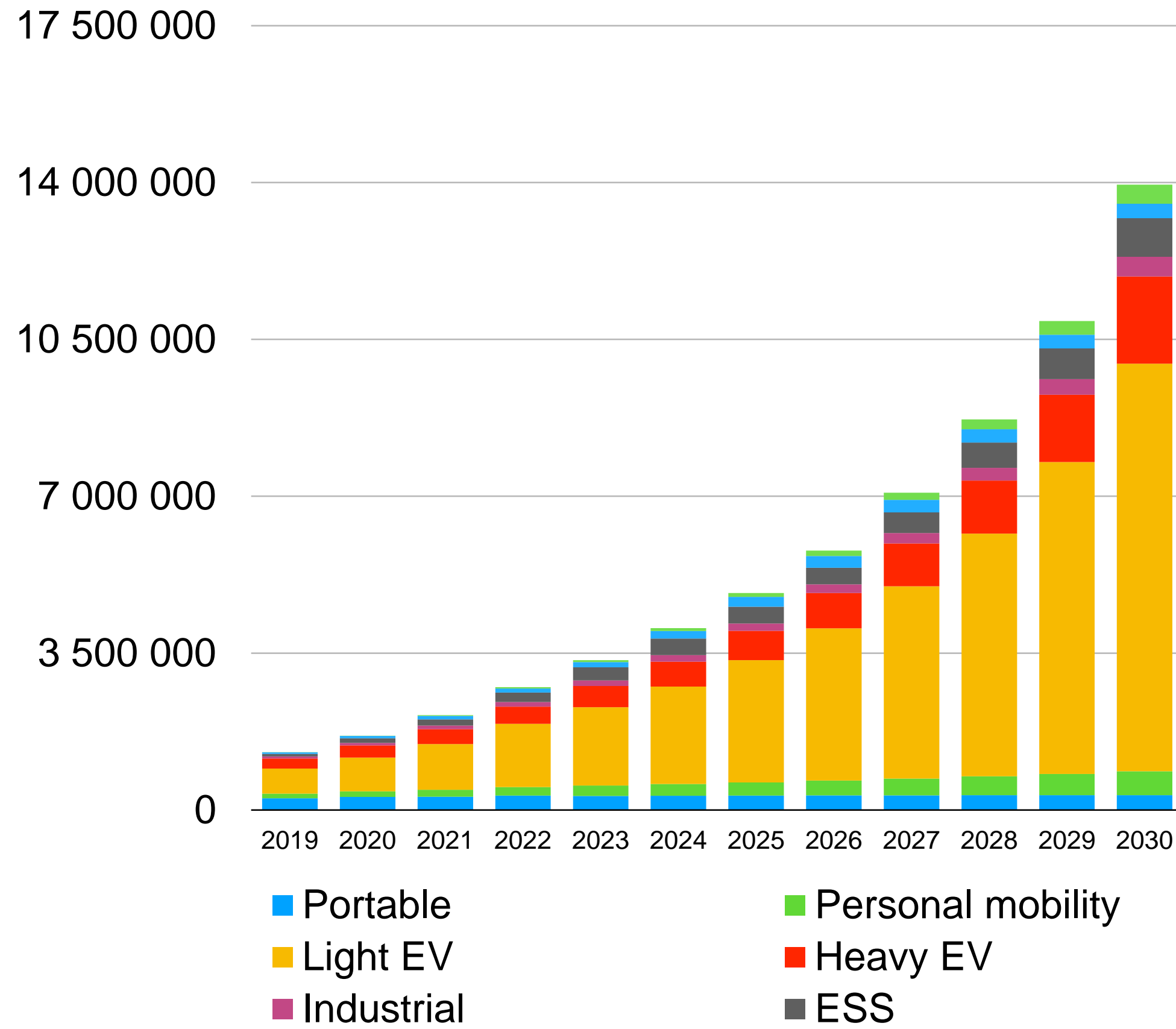
The lithium-ion revolution

Batteries placed on the world wide market, GWh



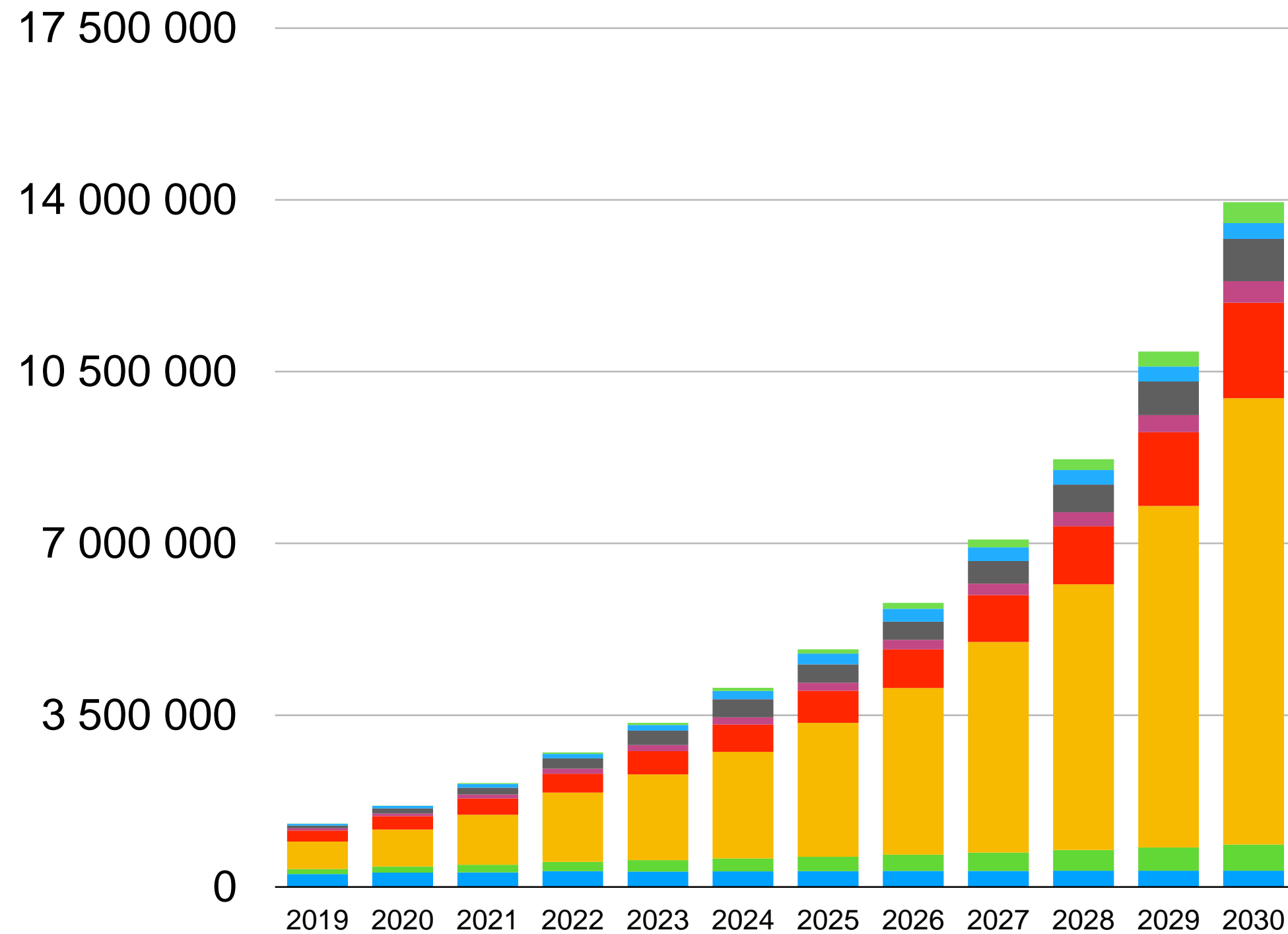
Placed on the market vs end of life

Batteries placed on the worldwide by application (tonnes)



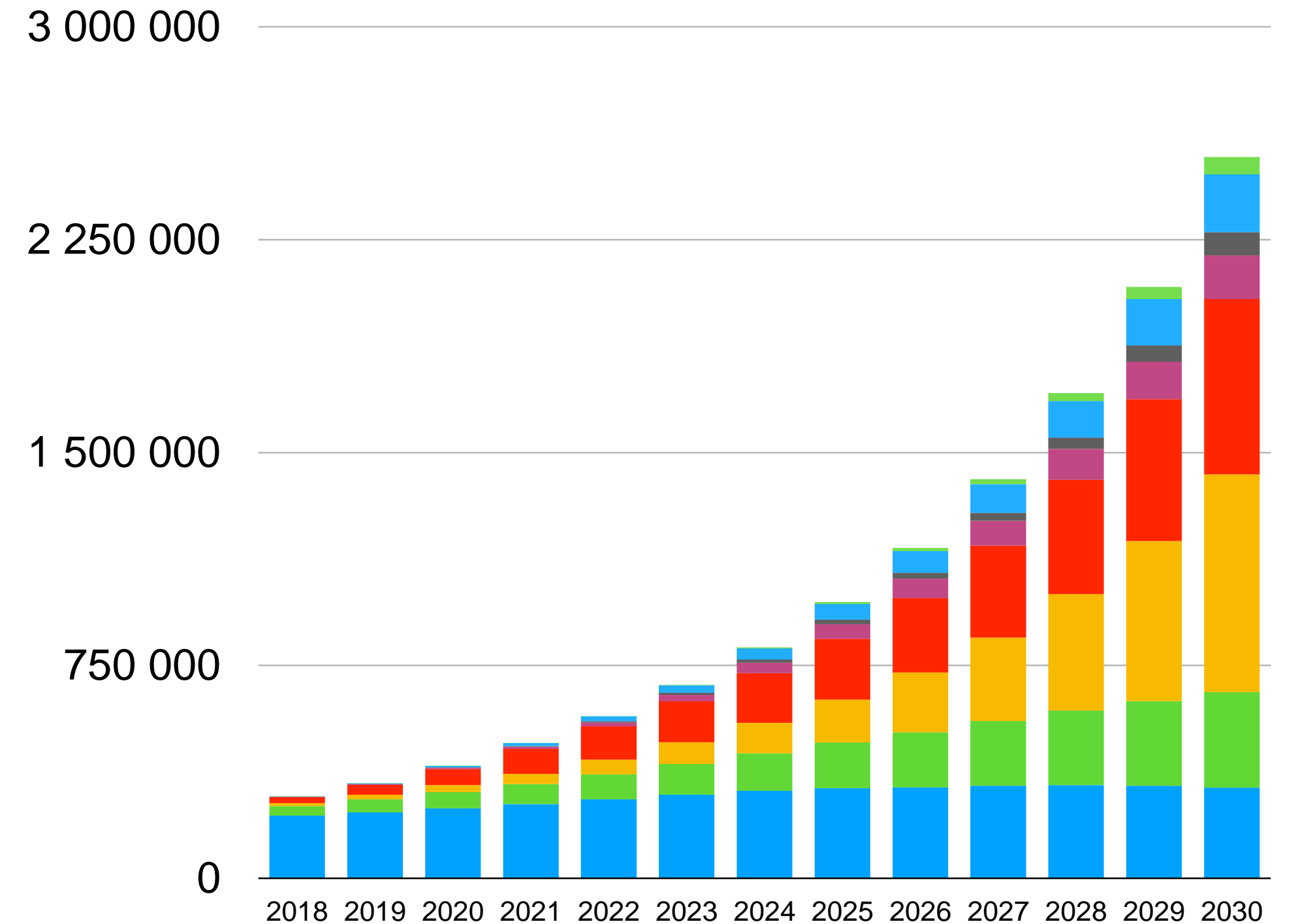
Placed on the market vs end of life

Batteries placed on the worldwide by application (tonnes)



- Portable
- Light EV
- Industrial
- Personal mobility
- Heavy EV
- ESS

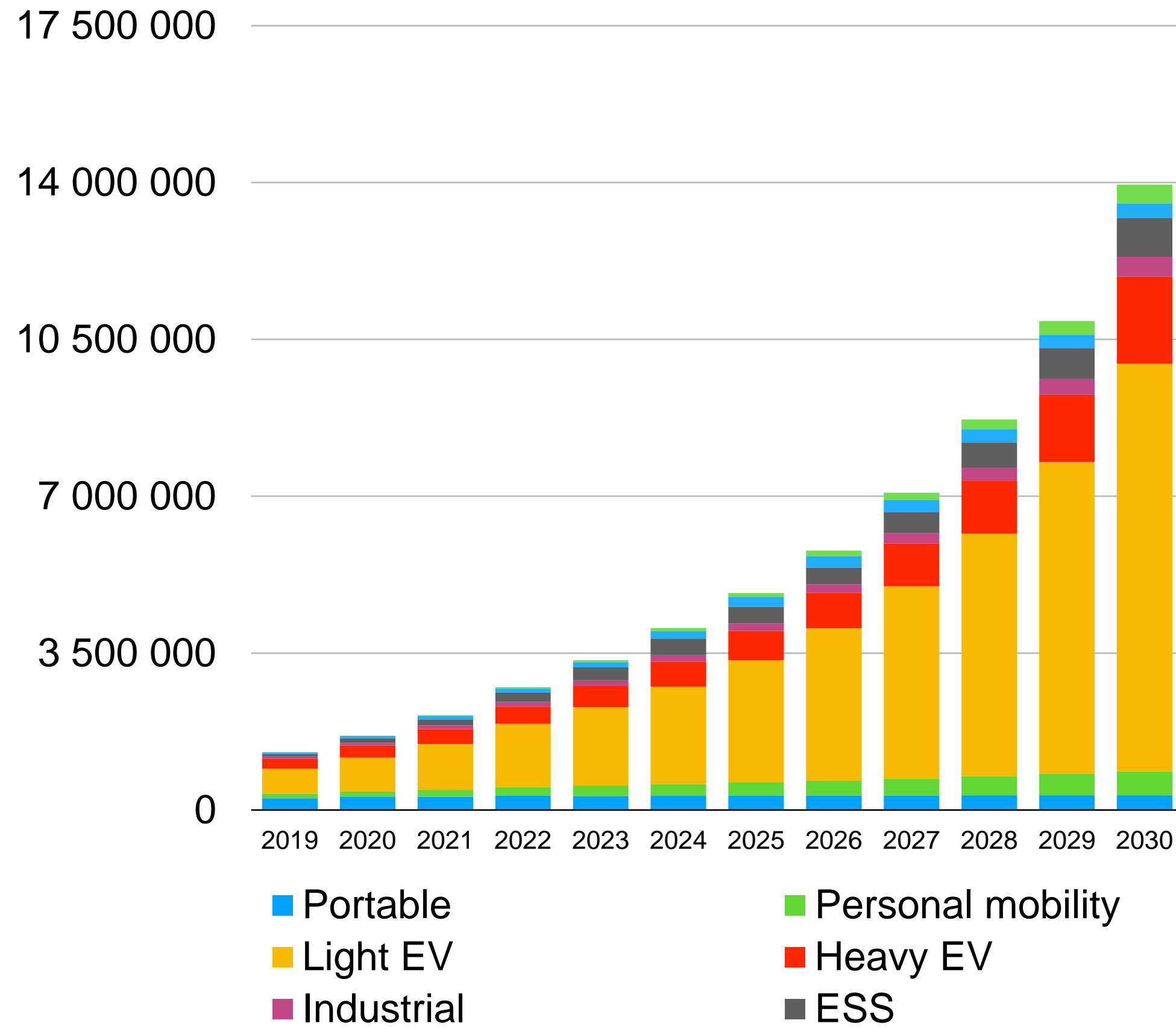
LIBs end of life world wide, by application (tonnes)



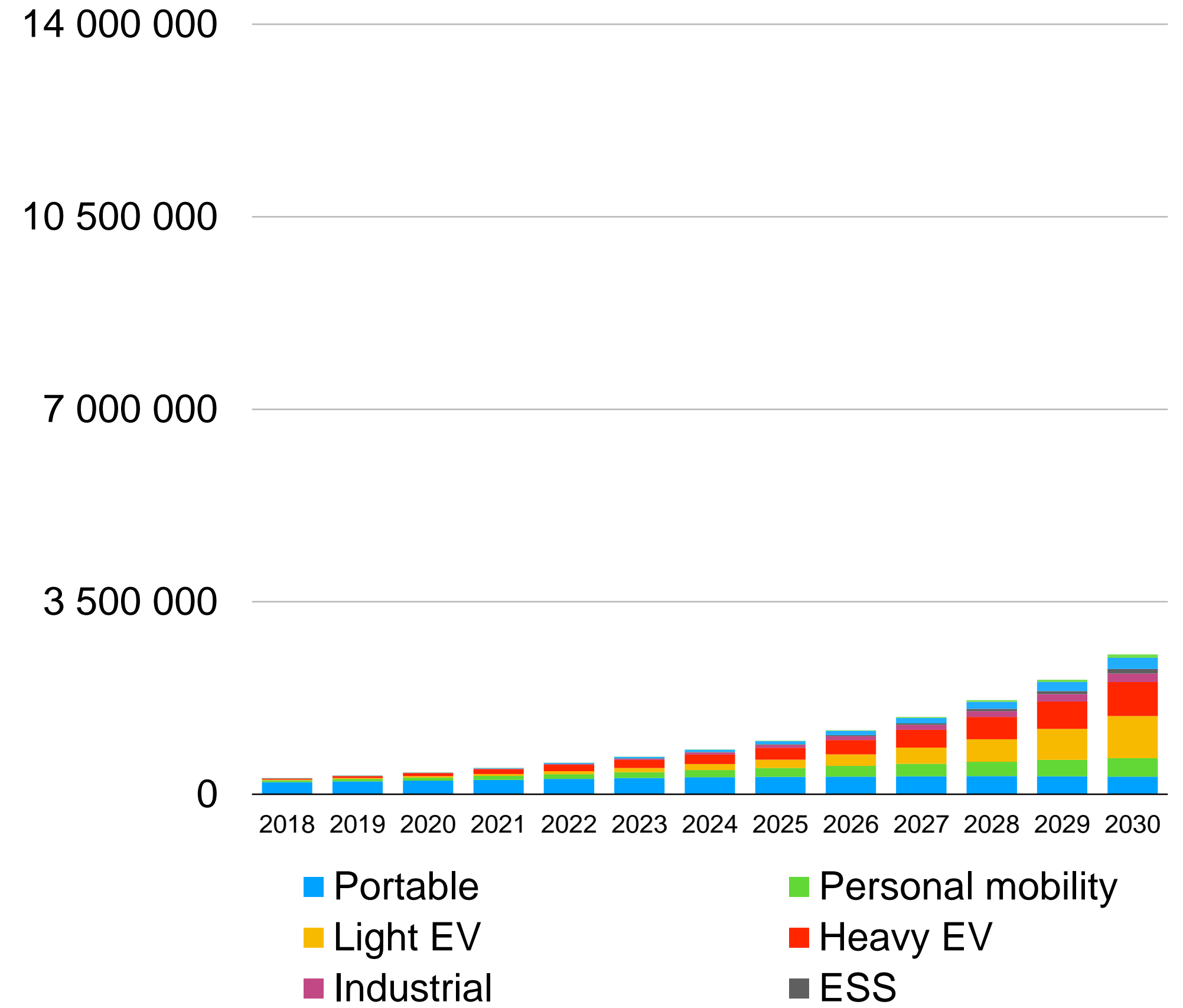
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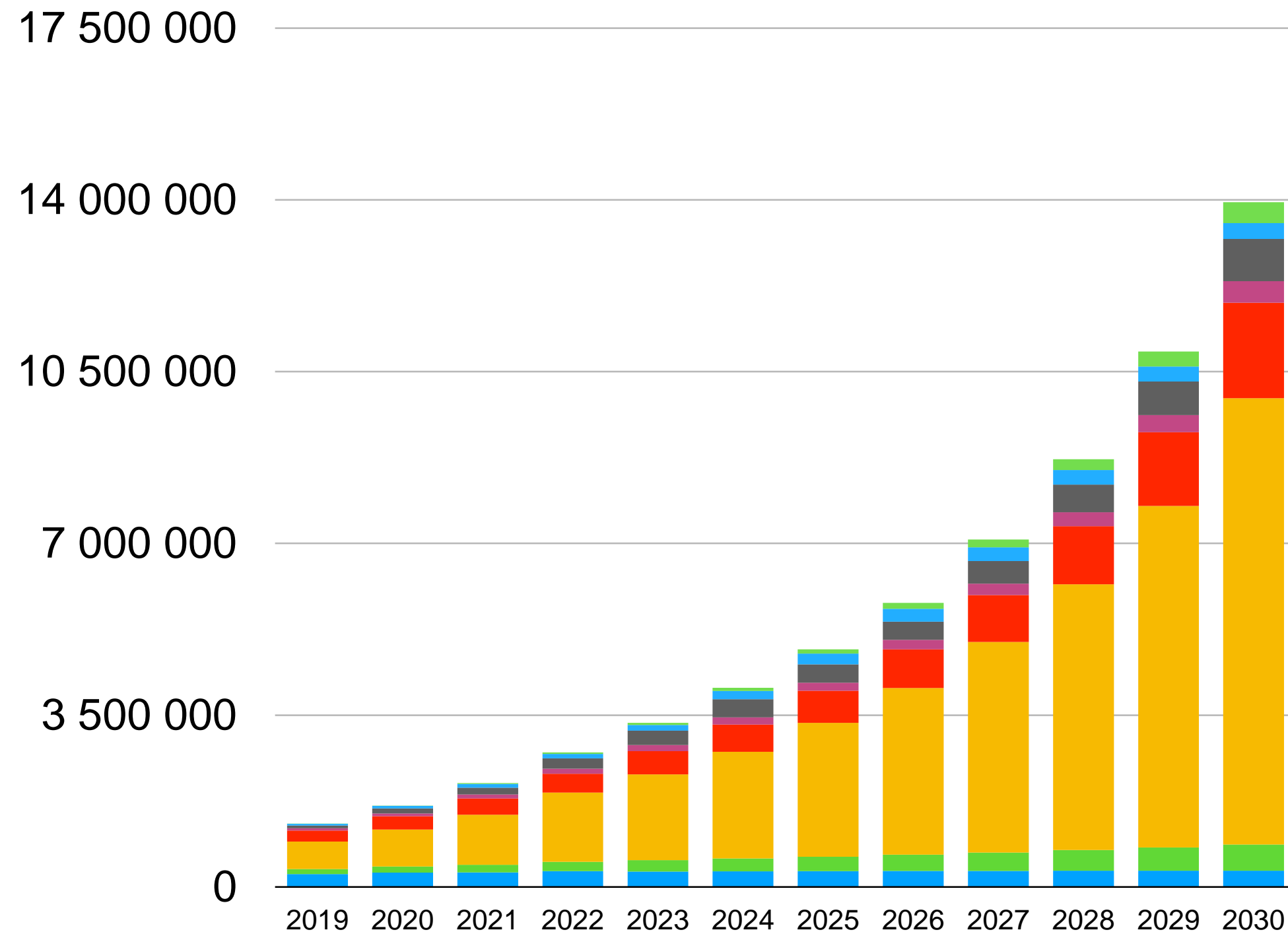


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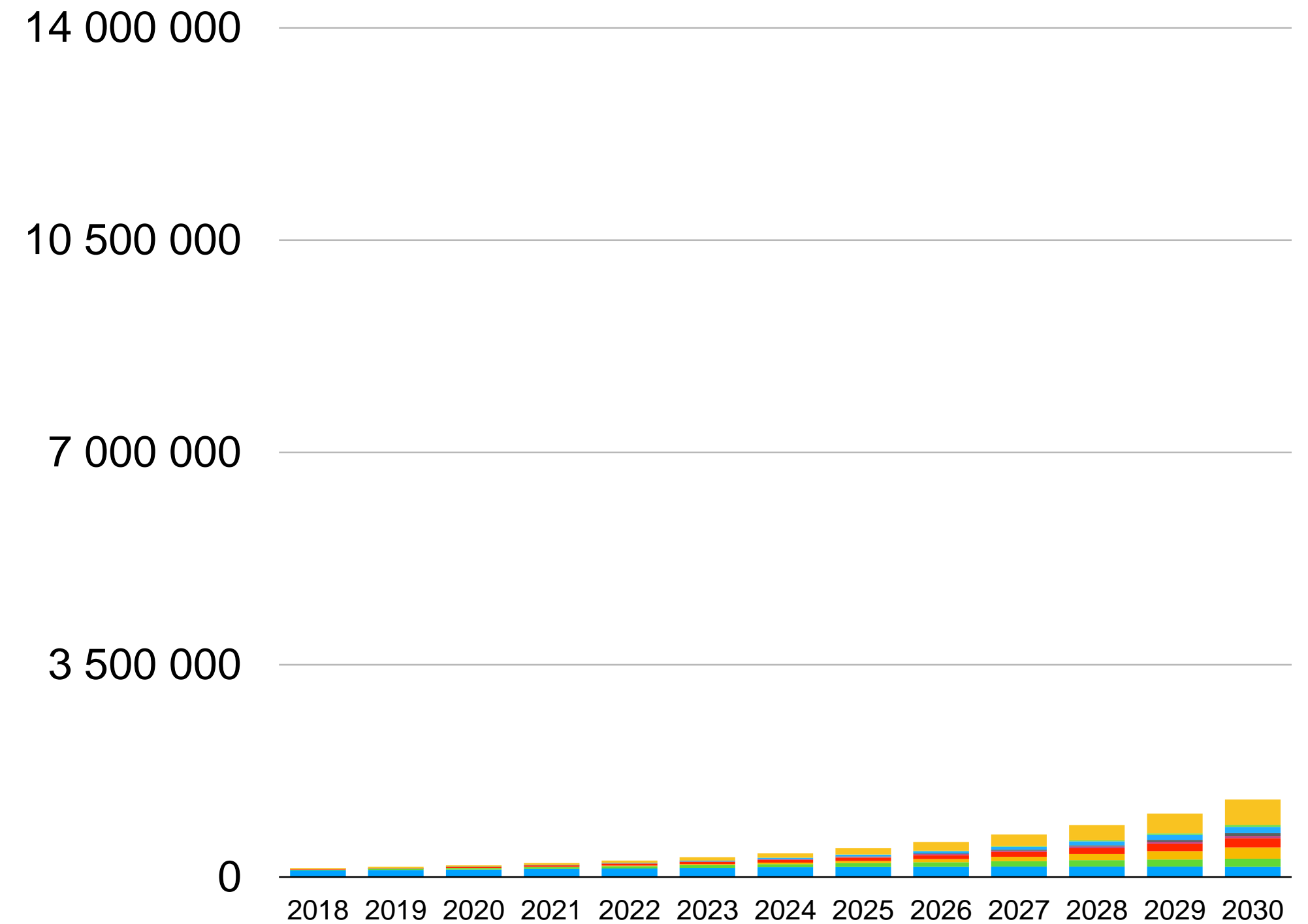
Placed on the market vs end of life

Batteries placed on the worldwide by application (tonnes)



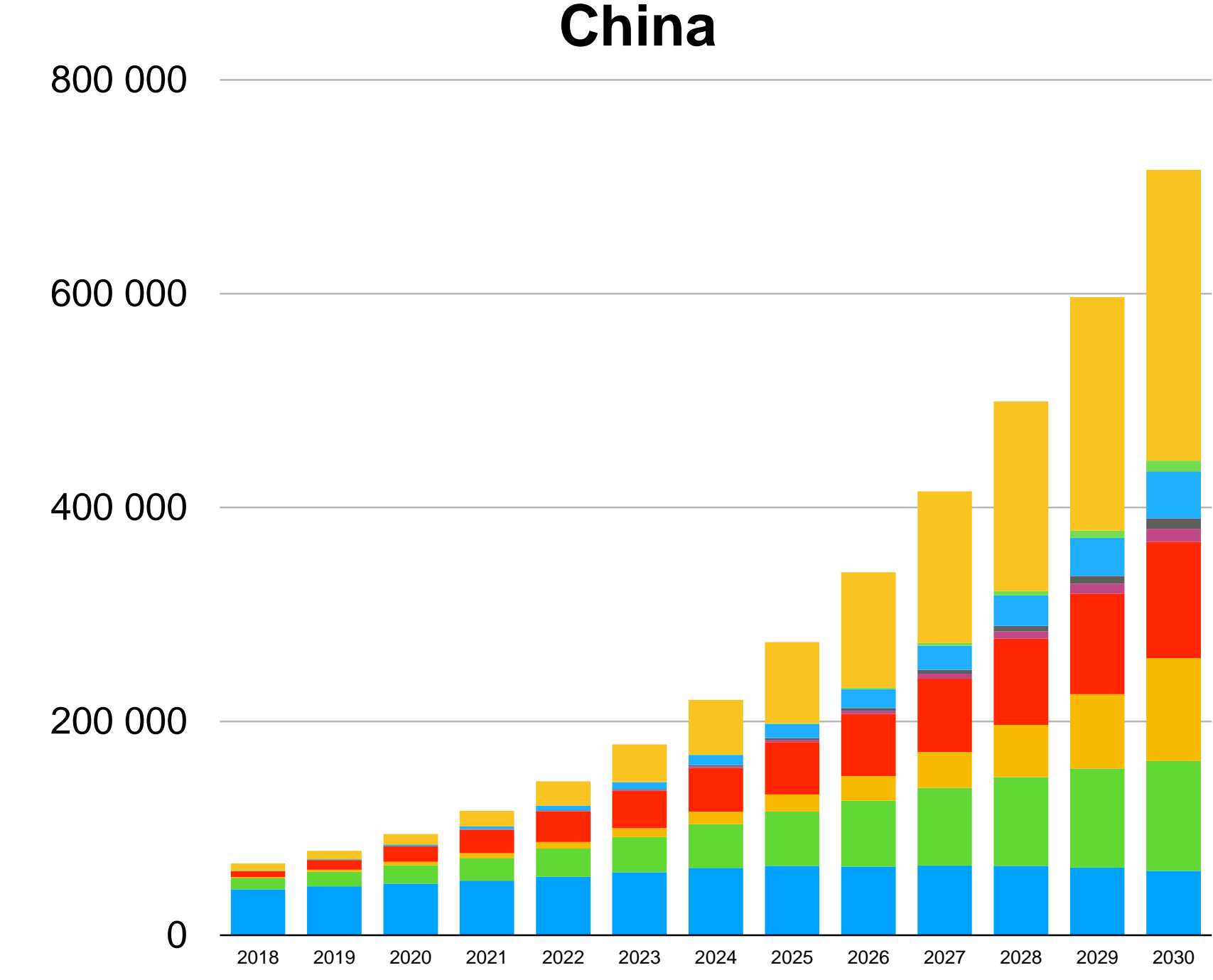
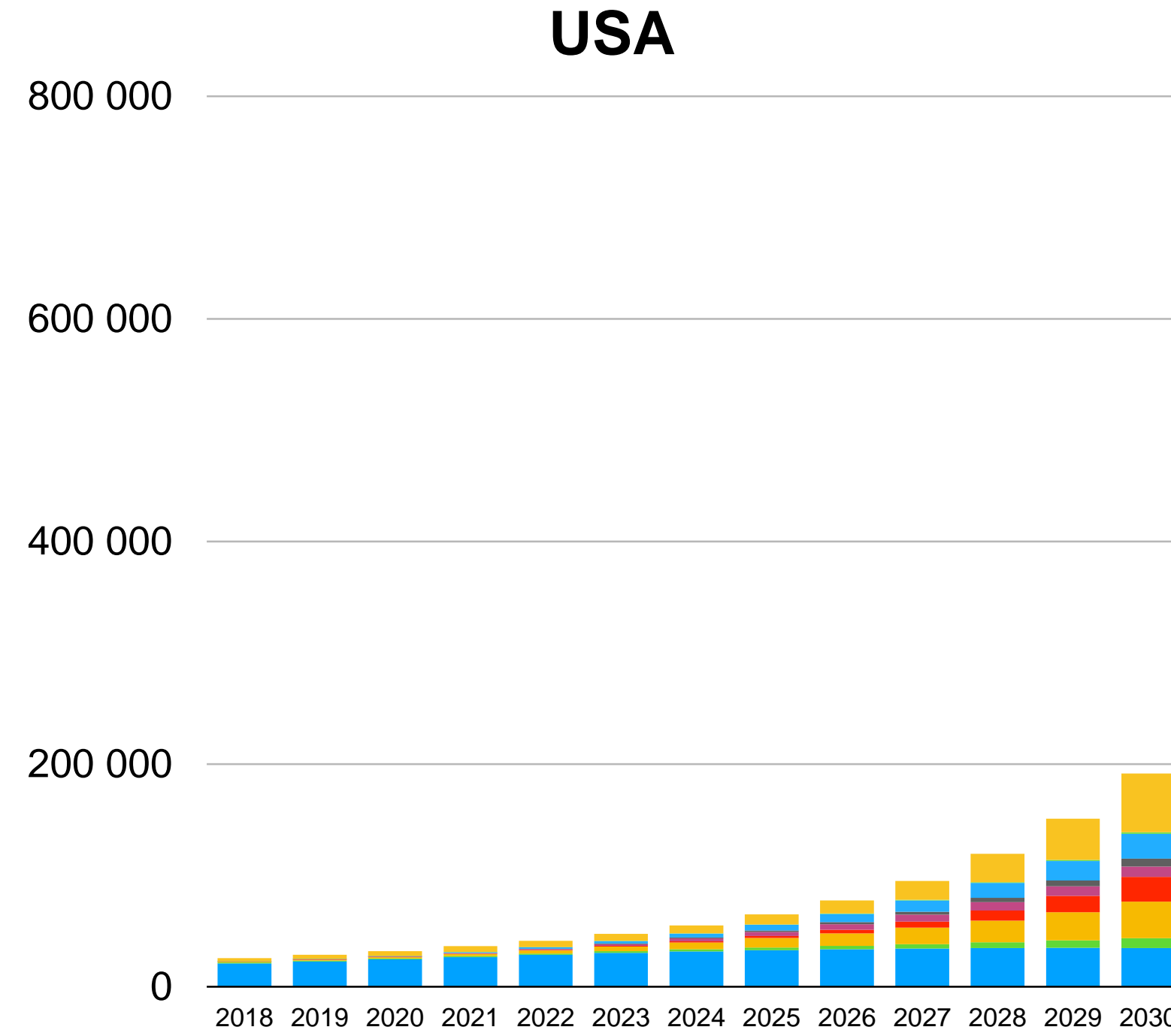
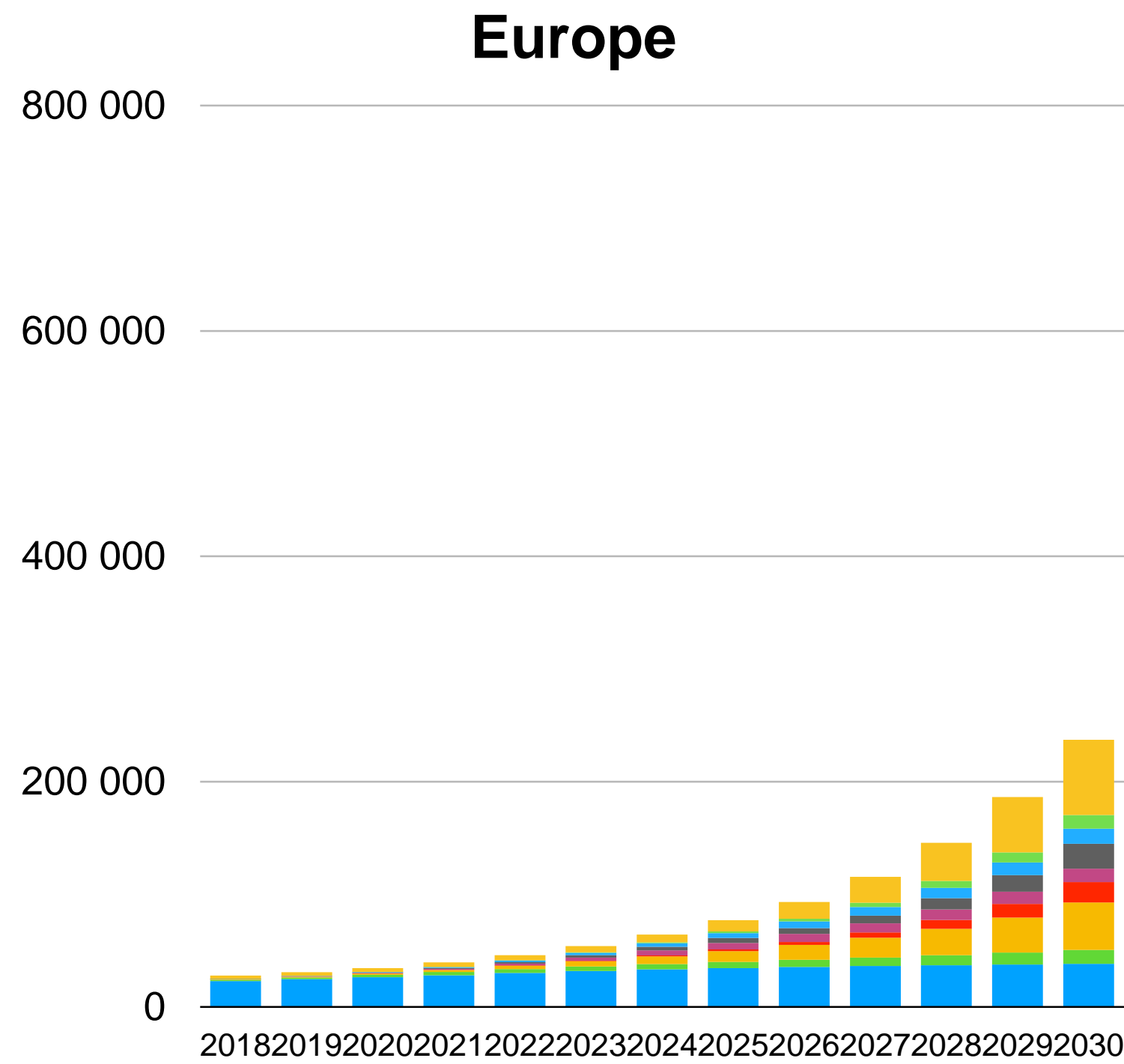
- Portable
- Light EV
- Industrial
- Personal mobility
- Heavy EV
- ESS

LIBs available for recycling world wide, by application (tonnes)



- Portable
- Light EV
- Industrial
- Personal mobility
- Heavy EV
- ESS

Regional differences in what's available for recycling

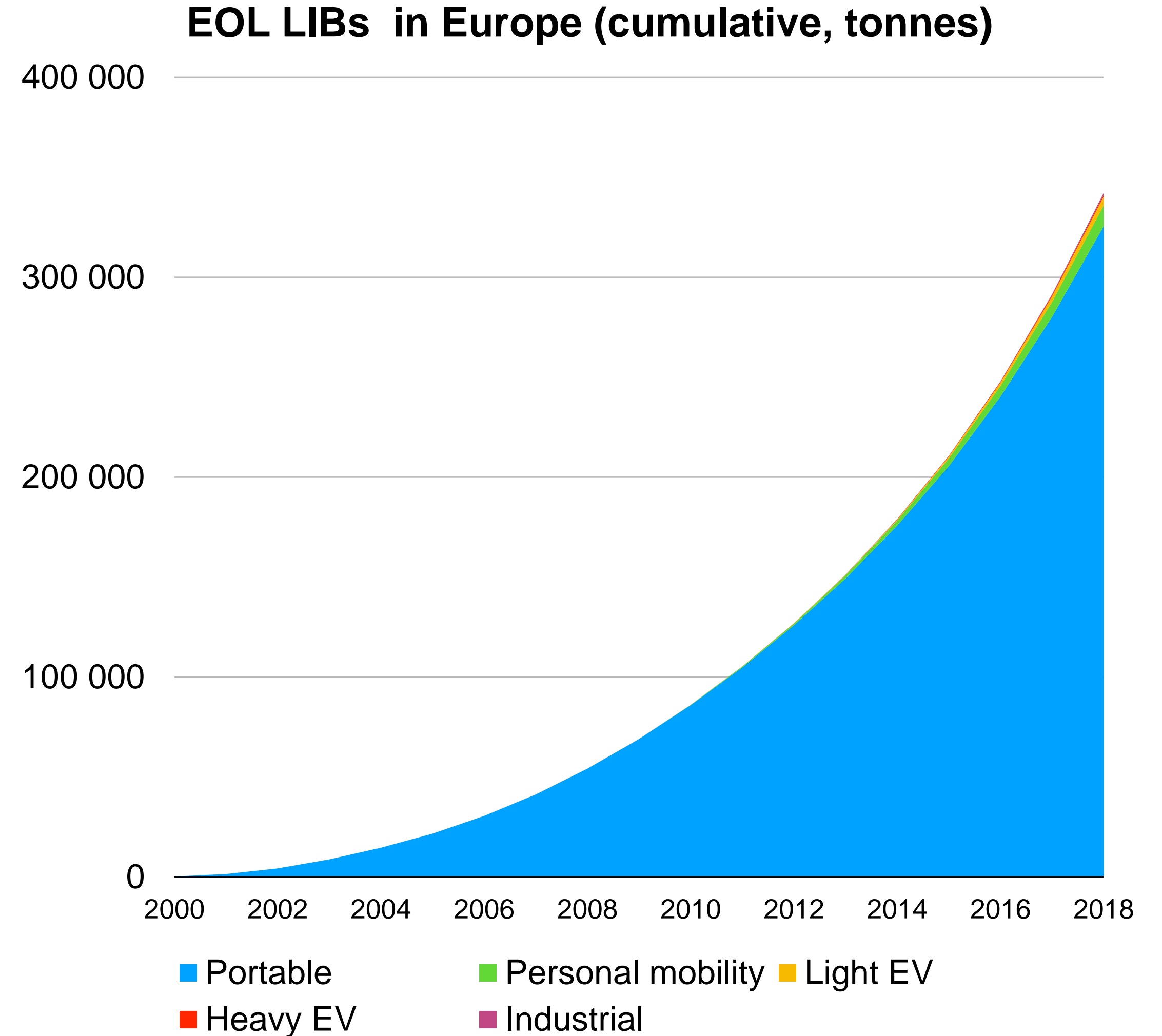
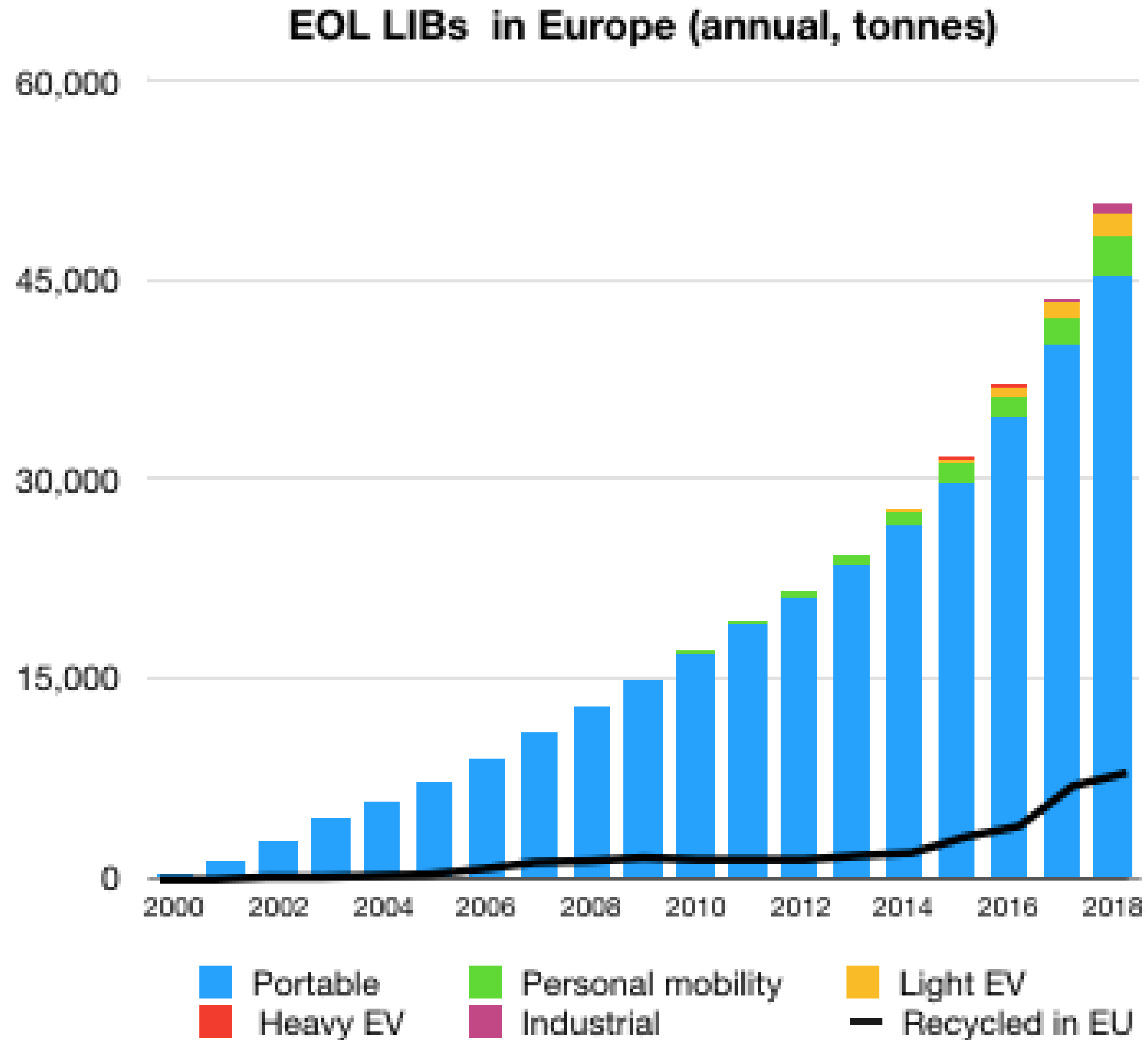


- Portable
- Heavy EV
- UPS/back up
- Personal mobility
- Industrial
- Maritime
- Light EV
- ESS
- Reused

- Portable
- Light EV
- UPS/back up
- Personal mobility
- Heavy EV
- ESS
- Maritime

- Portable
- Light EV
- UPS/back up
- Personal mobility
- Heavy EV
- ESS
- Maritime

Historical end-of-life volumes in Europe



The price for battery recycling

Value per kg:

\$1.5/kg – -\$5/kg

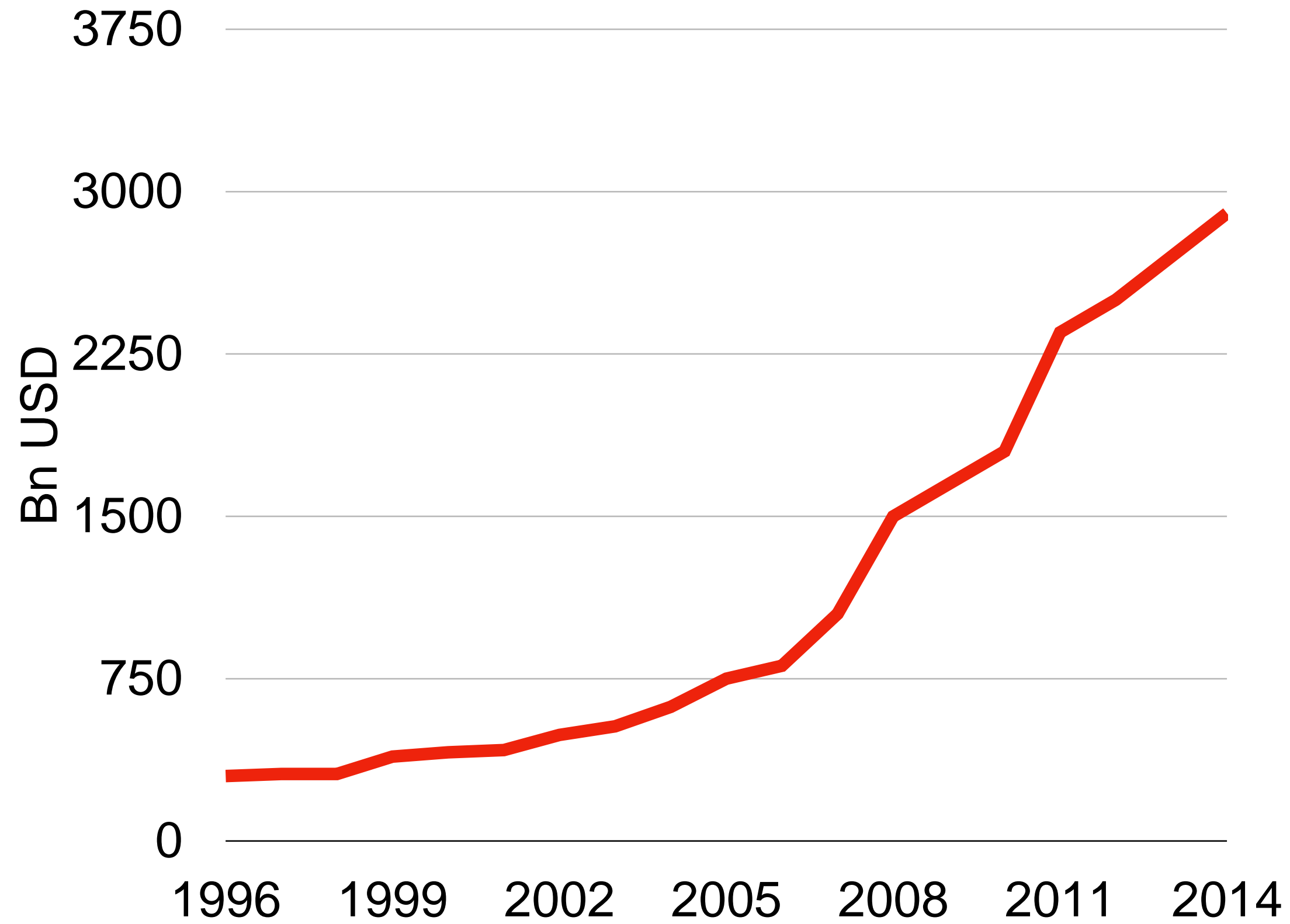


The Makers Revolution

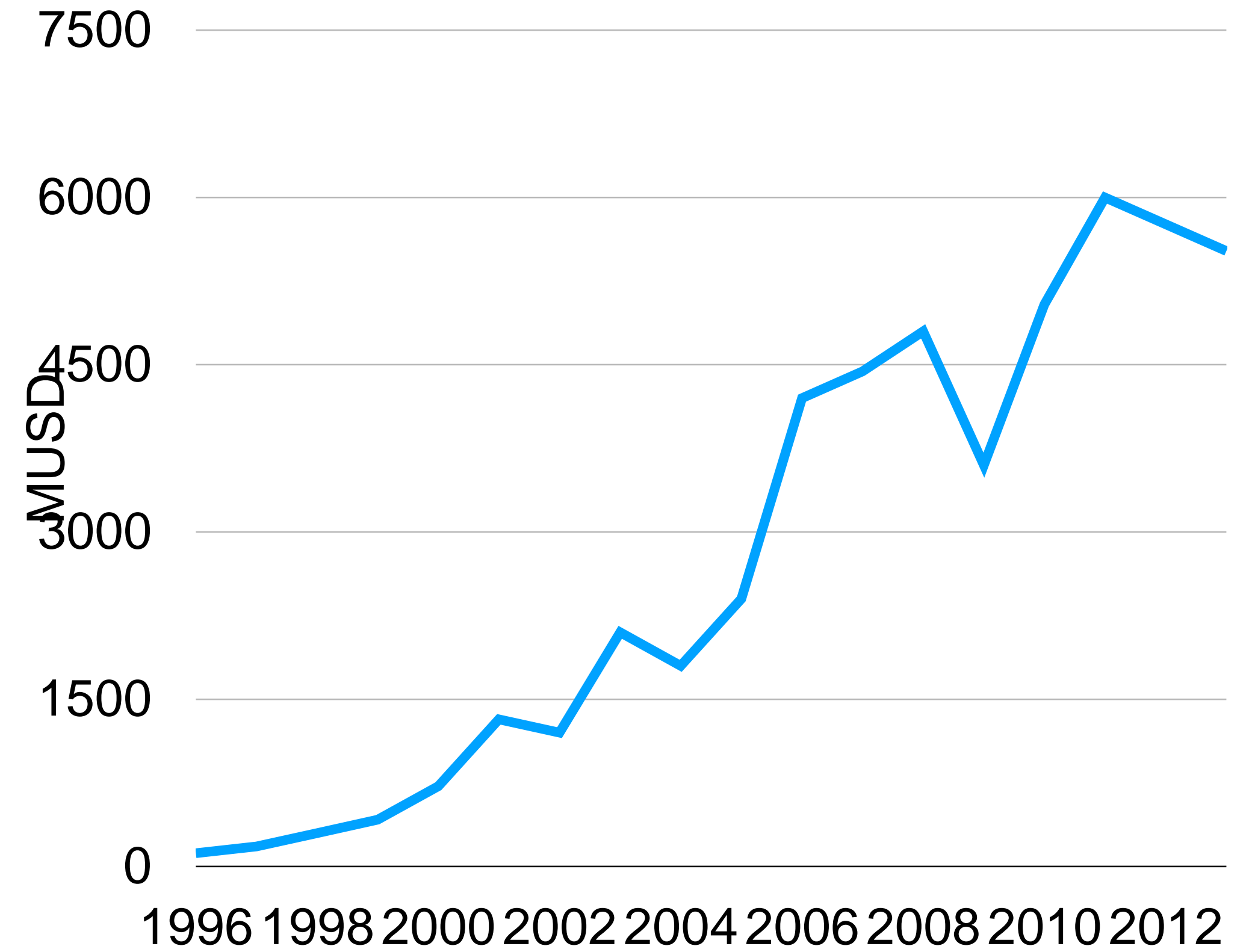


Scrap is food

Manufacturing output China

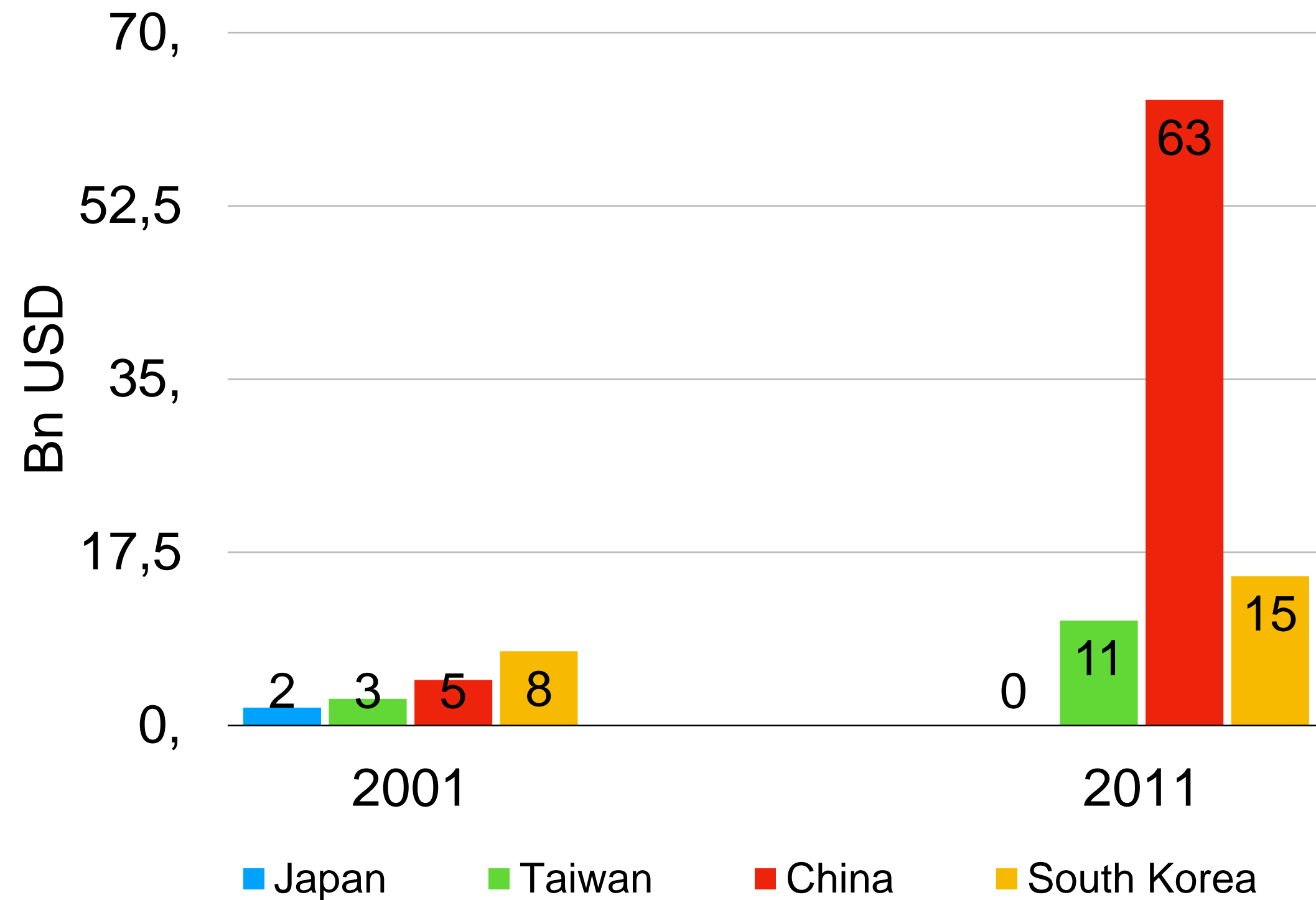


US scrap export to China

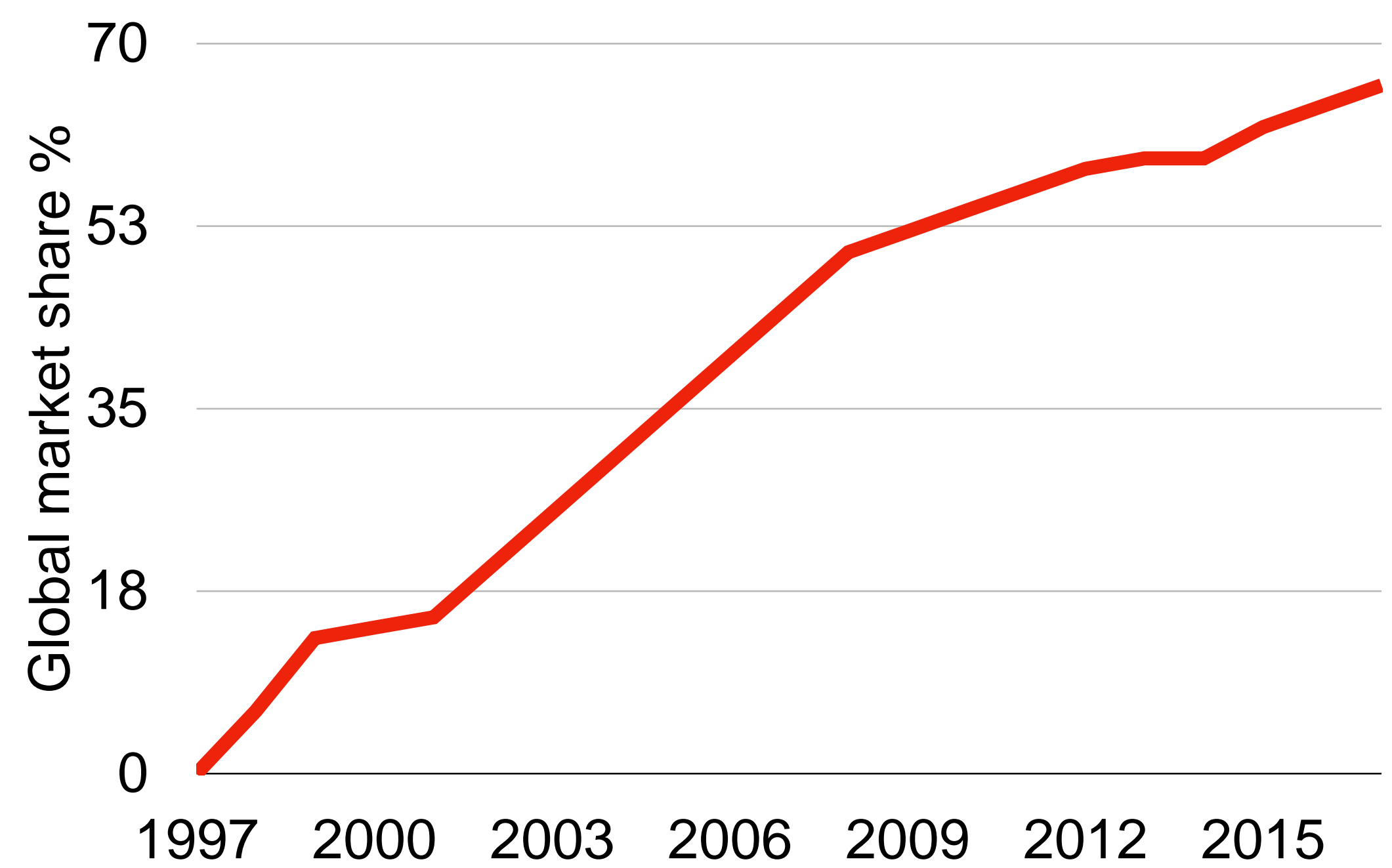


Extreme growth generate extreme demand

Mobile phone exports



China's market share lithium-ion battery production



降低能耗 挑战极限
Reducing Energy Consumption, Challenging the Limits

反皮釜(三)

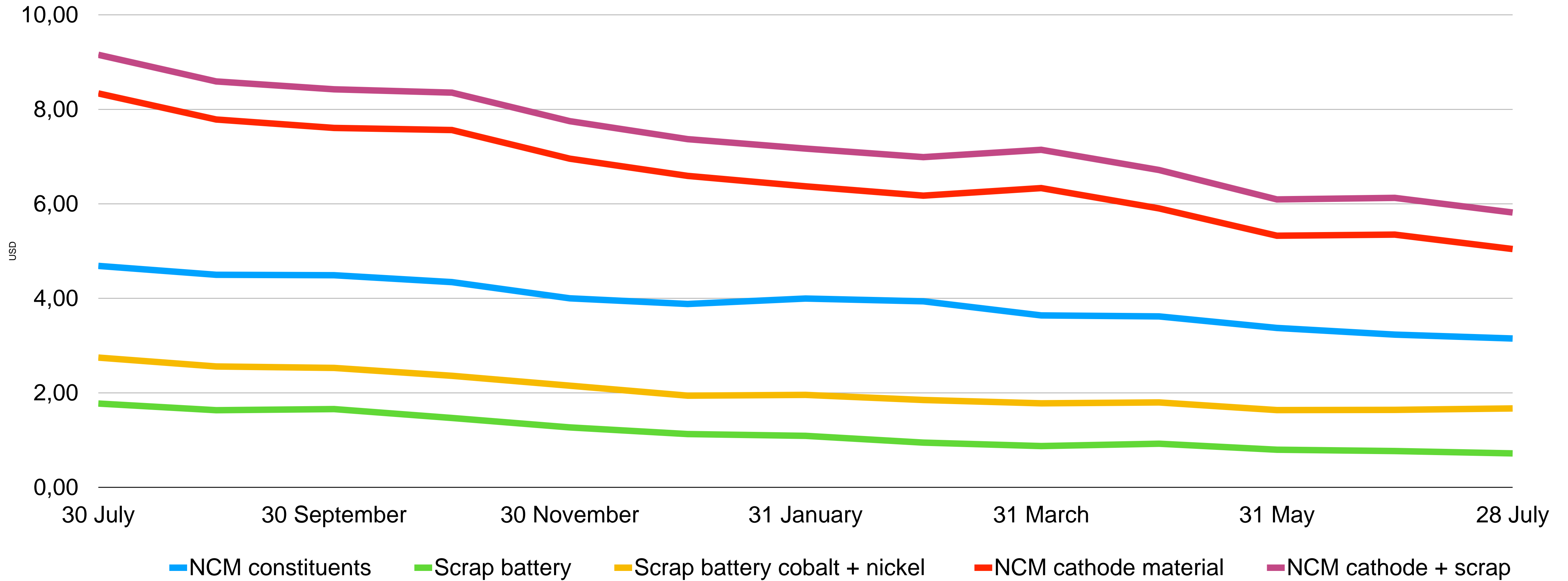
反皮釜(二)

反皮釜(一)



Price for recycled batteries

Material value of 1 kg scrap battery H2 2018-H2 2019




The power of production



Your phone is valuable – thanks to China

Apple iPhone 6 32GB



£45.00

Sell Phone



JOBLOT MOBILE SMART PHONES SAMSUNG NOKIA SPARES REPAIR FAULTY BROKE 99p AUCTIONS

Parts only

£39.00 30-Sep 19:33

17 bids
+ £4.95 postage

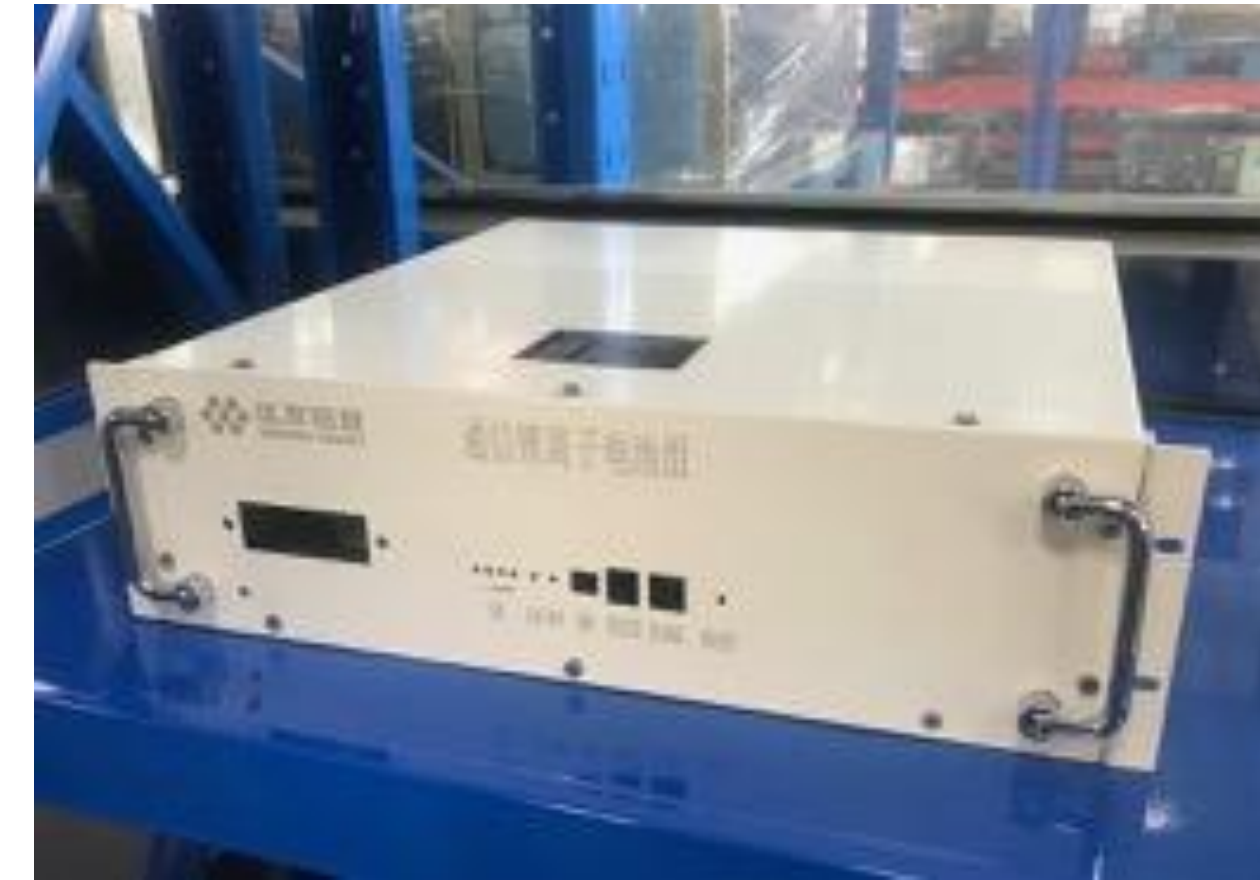
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Even reuse of batteries are driving volumes

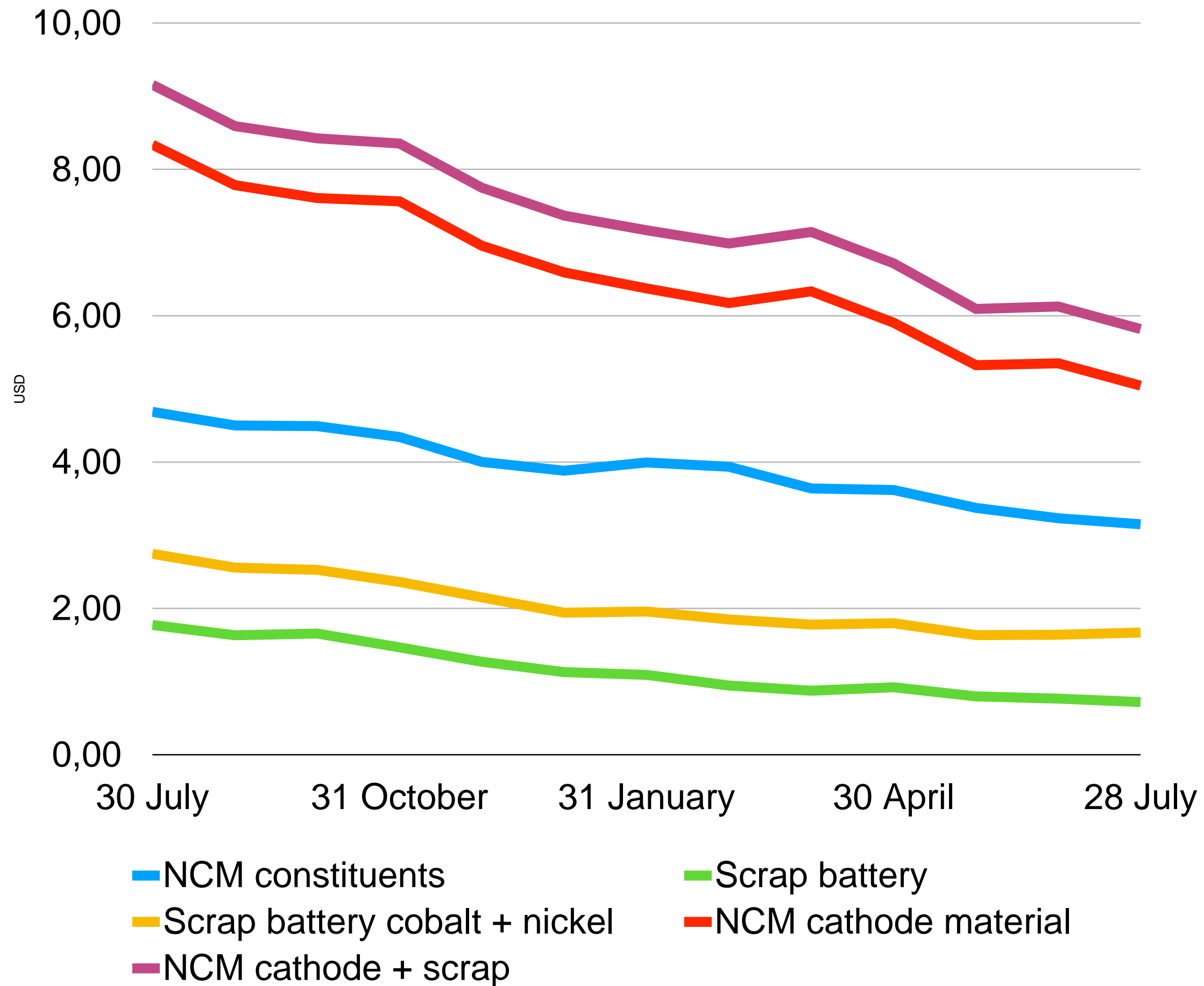


And second life is driving battery collection



Price for end-of-life batteries

Material value of 1 kg scrap battery H2 2018-H2 2019



Nissan Leaf modules \$10 – \$20/kg



CALB cells \$20/kg

Reuse of batteries



Residential and C&I ESS



Utility-scale ESS



EV charging



Telecom base stations



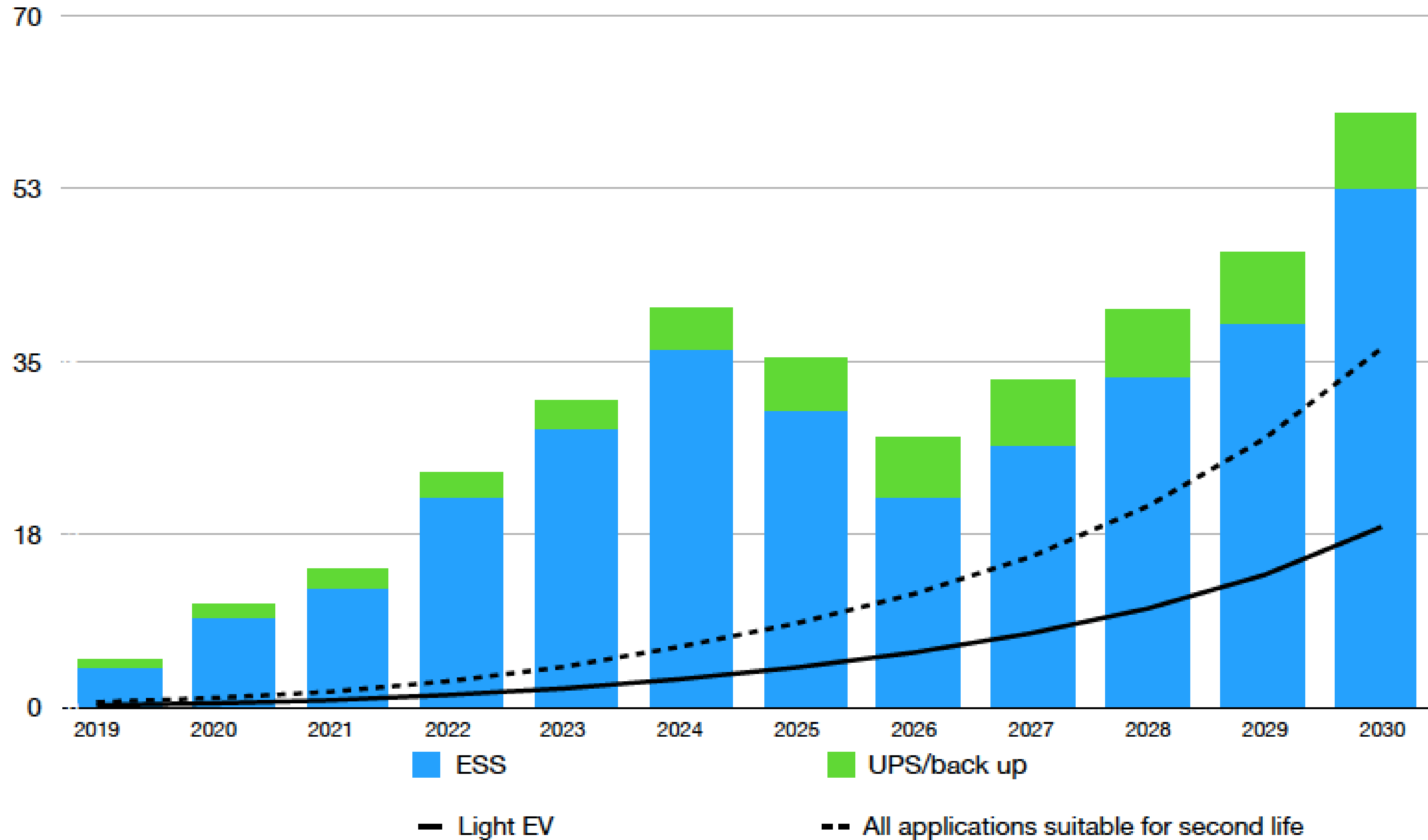
Low speed vehicles



Lead-acid replacement

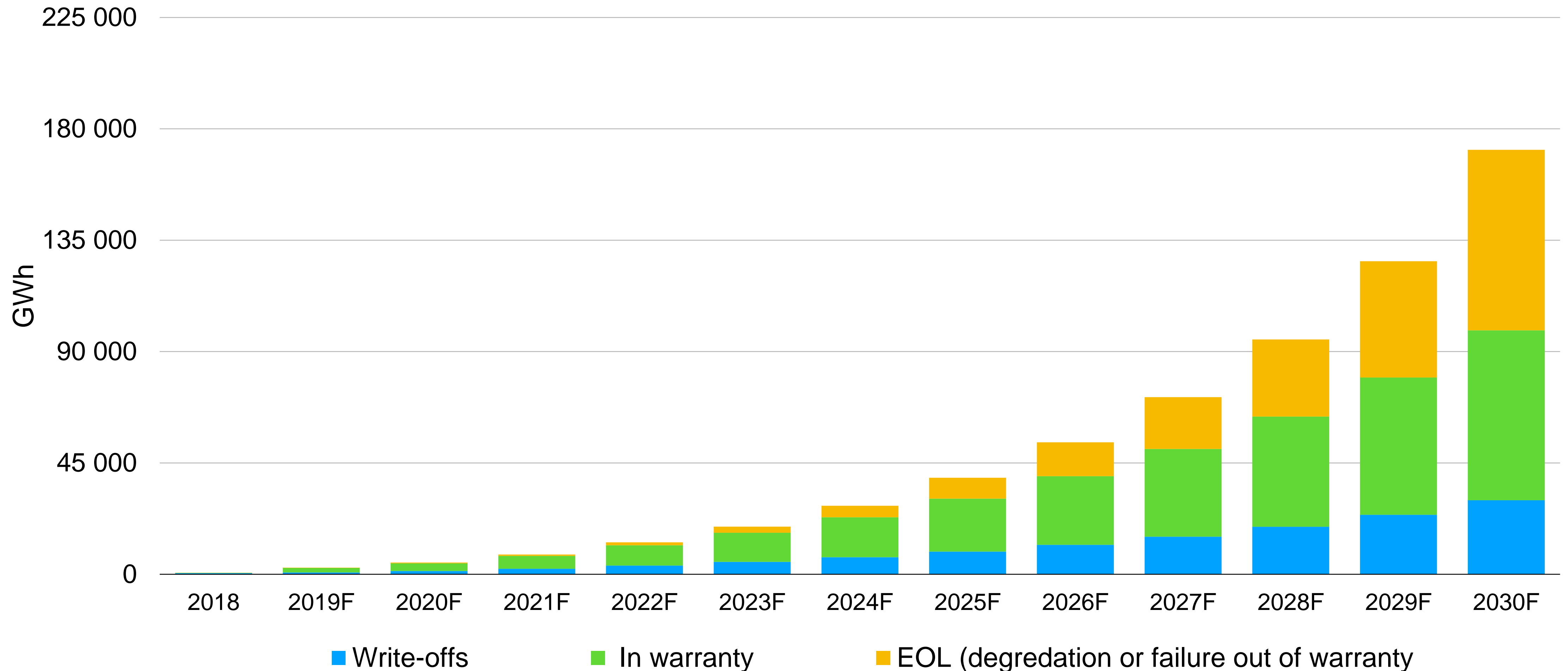
Demand vs supply

Available second life batteries compared to projected demand for ESS and UPS installations in Europe (GWh)



Different fates of batteries based on their end-of-life route

Estimated cause of EOL EV batteries, Europe, tonnes



Thank you!

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