Automotive & Renewable Energy

Why would lithium battery recycling take a centre stage in India by 2030?

While the growth of EV's are inevitable in the country it is also certain that it will unfold its own challenge of recycling it with them approaching the end-of-life

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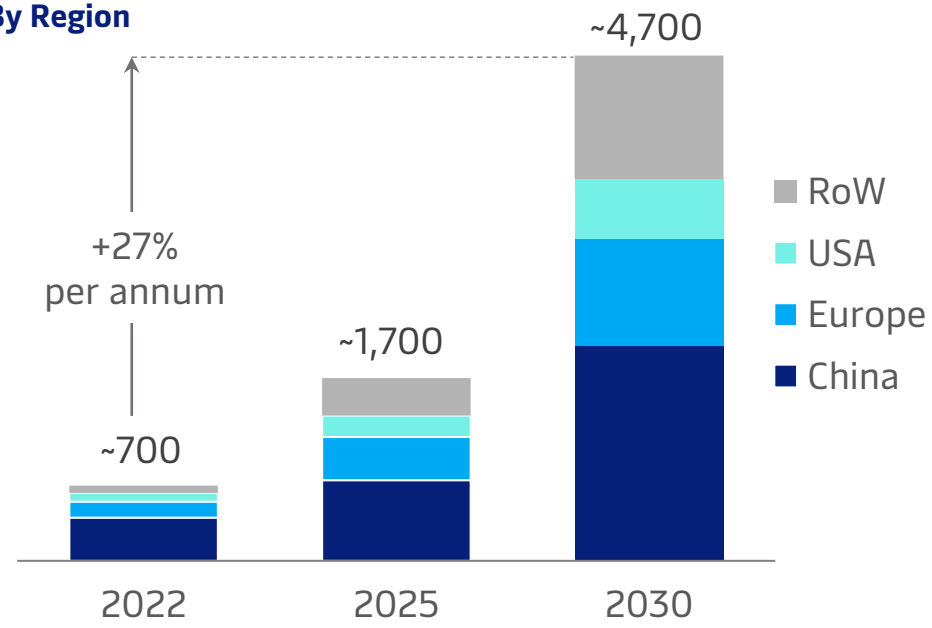
EV batteries recycling is likely to garner center stage in India with push coming from EV OEMs

Globally, the electric mobility is finding greater penetration which shall see the need for electric vehicles batteries rising as well. This would lead to a massive growth in requirement of batteries which could be around **5 TWh annually by 2030** on global levels. Consecutively, the EV battery volumes reaching end-of-life would be close to **100 million** in the decade and will call for recycling.

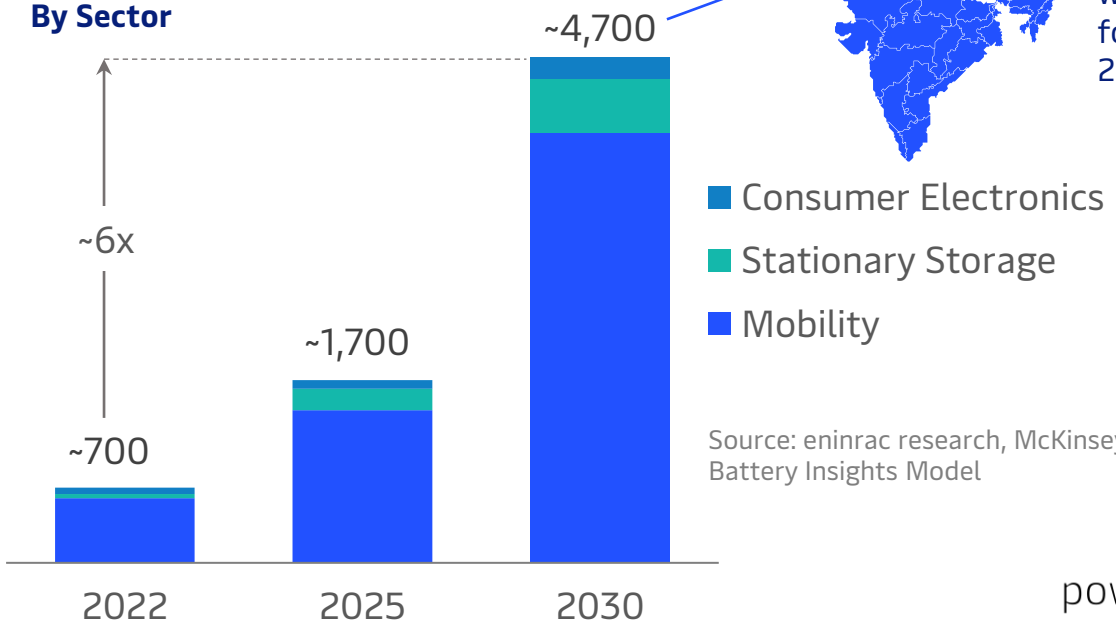
While moving from IC Engines to electric mobility is overall good for environment (deeper analysis in lithium and other crucial minerals mining is required though) but to overhaul our entire transportation new supply chain must be created and augmented. For a country like India which had until the recent findings of reserves in Jammu & Kashmir and potentially in Rajasthan was completely dependent on imports of lithium to support local battery manufacturing. Therefore, for a country like India it becomes quintessential to quickly scale an ecosystem which is resilient, stable, efficient and consistent supply chain which is sustainable as well.

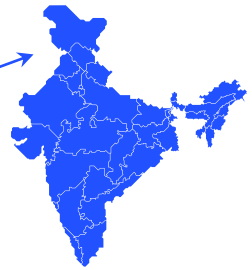
Global Li-ion battery cell demand, GWh, Base Case

By Region



By Sector

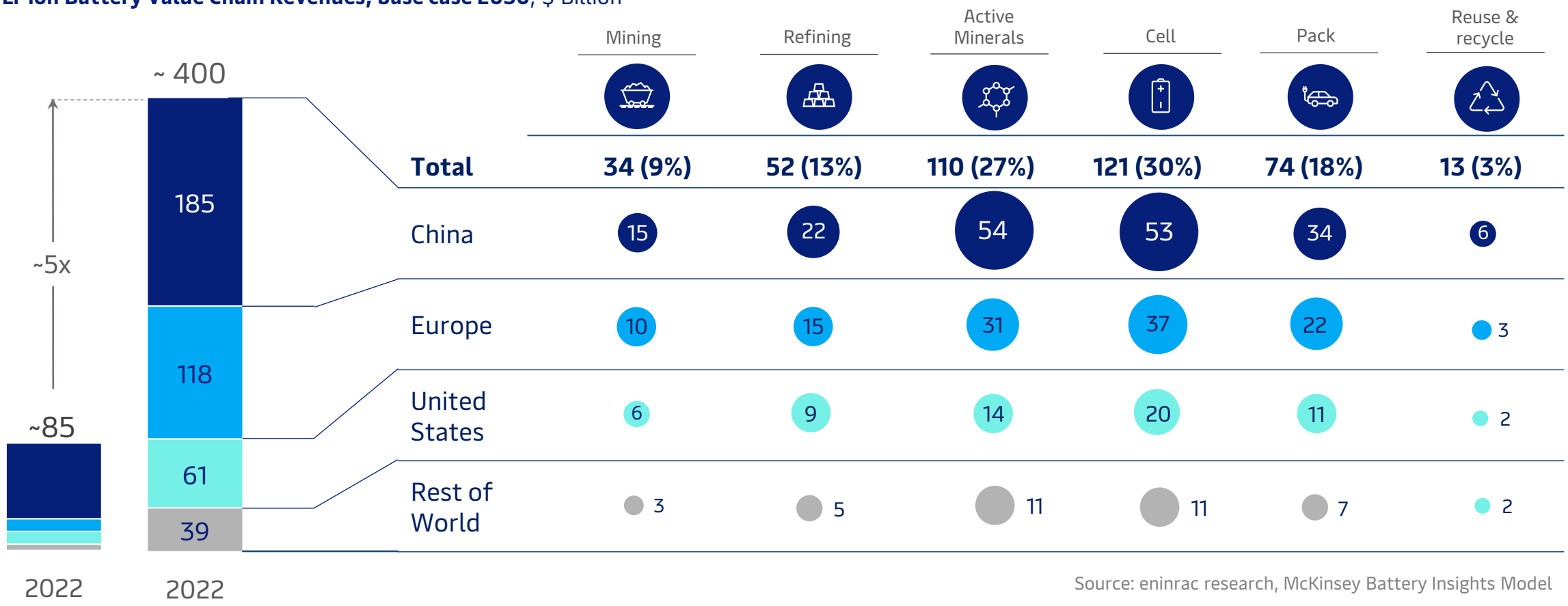




~ 5-7% of total market share would be India's for recycling by 2030

Source: eninrac research, McKinsey Battery Insights Model

Li-ion Battery Value Chain Revenues, base case 2030, $ Billion



Source: eninrac research, McKinsey Battery Insights Model

In line with surging demand of li-ion batteries across multiple industries, the global revenues along the value chain is expected to boosted up nearly 5 times from $85 Billion in 2022 to **$400 Billion** by 2030. However, this may further see a northbound trend if the lithium reserves discovered in India come online and manufacturing of li-ion batteries in the country increases. Although, recycling would lead to smallest of revenue pools but with India turning into manufacturing hotspot we can see the pool of nearly **$2-5 Billion** in the country on the lines with China. Also, in the value chain lithium refining, active minerals extraction, cells, and rack would kick-off as bigger opportunity pools gaining maturity curve in the country.

Factors driving EV battery recycling in India & Globally – Fact check

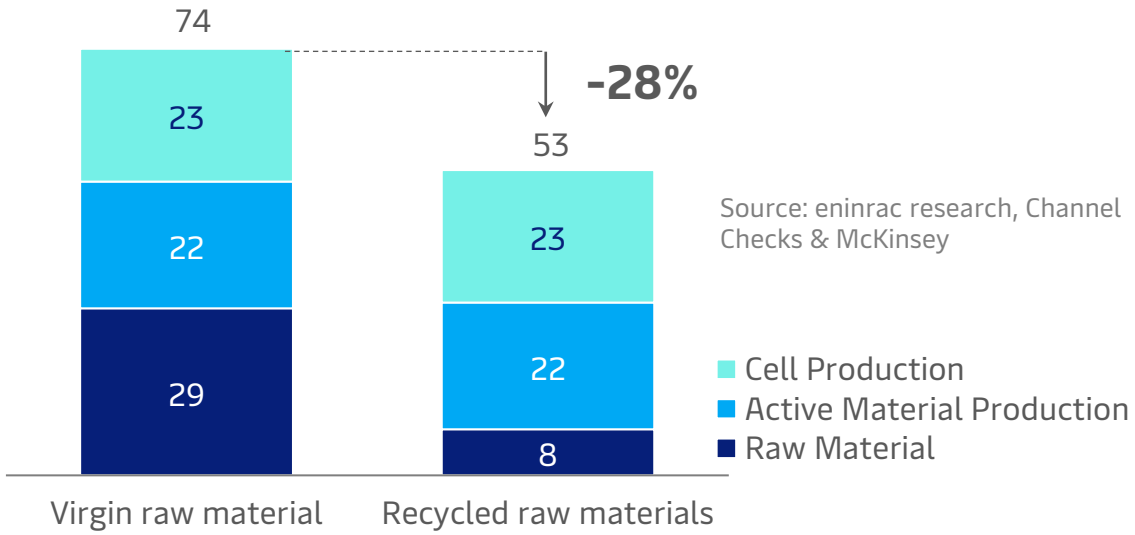
There are multiple factors across the globe which is likely to trigger the EV battery recycling. Foremost, are the *technological progress* as processes scale and mature are becoming natural enablers of higher recovery rates, lowering green-house gas emissions footprints and improving combined economics. Additionally, increasing investments in promoting R&D for enhancing recycling technologies and supply-chain stability being prioritized by OEMs who are more than willing to utilize recycled and local raw material volumes at stable prices are giving necessary push to the business case of recycling especially in a country like India. Further, a circular economy for lithium batteries is more important for a country like India which houses most polluted cities in the world.

We might see that OEMs in India can ink contracts on similar lines to what VW has done with Redwood Materials. Further, in 2022 GoI announced a mechanism for OEMs in the name of "Extended Producer Responsibility" (EPR) that shall make them responsible for collecting waste batteries, ensuring their refurbishment or recycling and recovery of key materials from them. It is noteworthy that decarbonization and ethical supply-chain management , given former is characterized by four times lower carbon emissions, resulting in a more than 25% lower carbon-emissions footprint per kWh of battery capacity produced.

"EPR, the principle in waste management globally, can really address both upstream as well as downstream issues of lithium – ion batteries (LIB). Introduction of an EPR based framework for LIBs and LIBs products with targets for collection and recovery can help in addressing in some of key concerns"

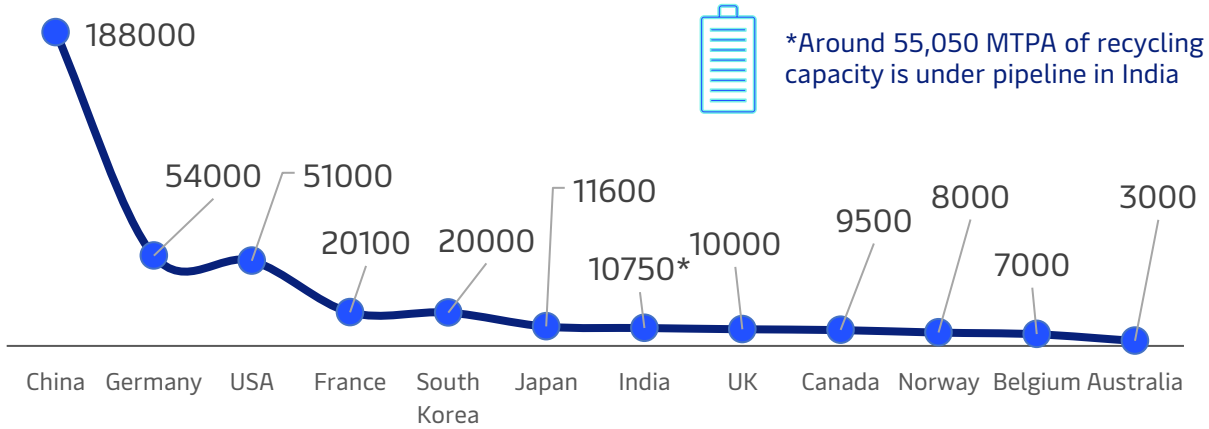
– Ravi Agarwal
Director, Toxic Links

Reduction in Carbon Footprint by Recycled Materials



Source: eninrac research, Channel Checks & McKinsey

China in Lead (Recycling Capacity, MTPA)



*Around 55,050 MTPA of recycling capacity is under pipeline in India

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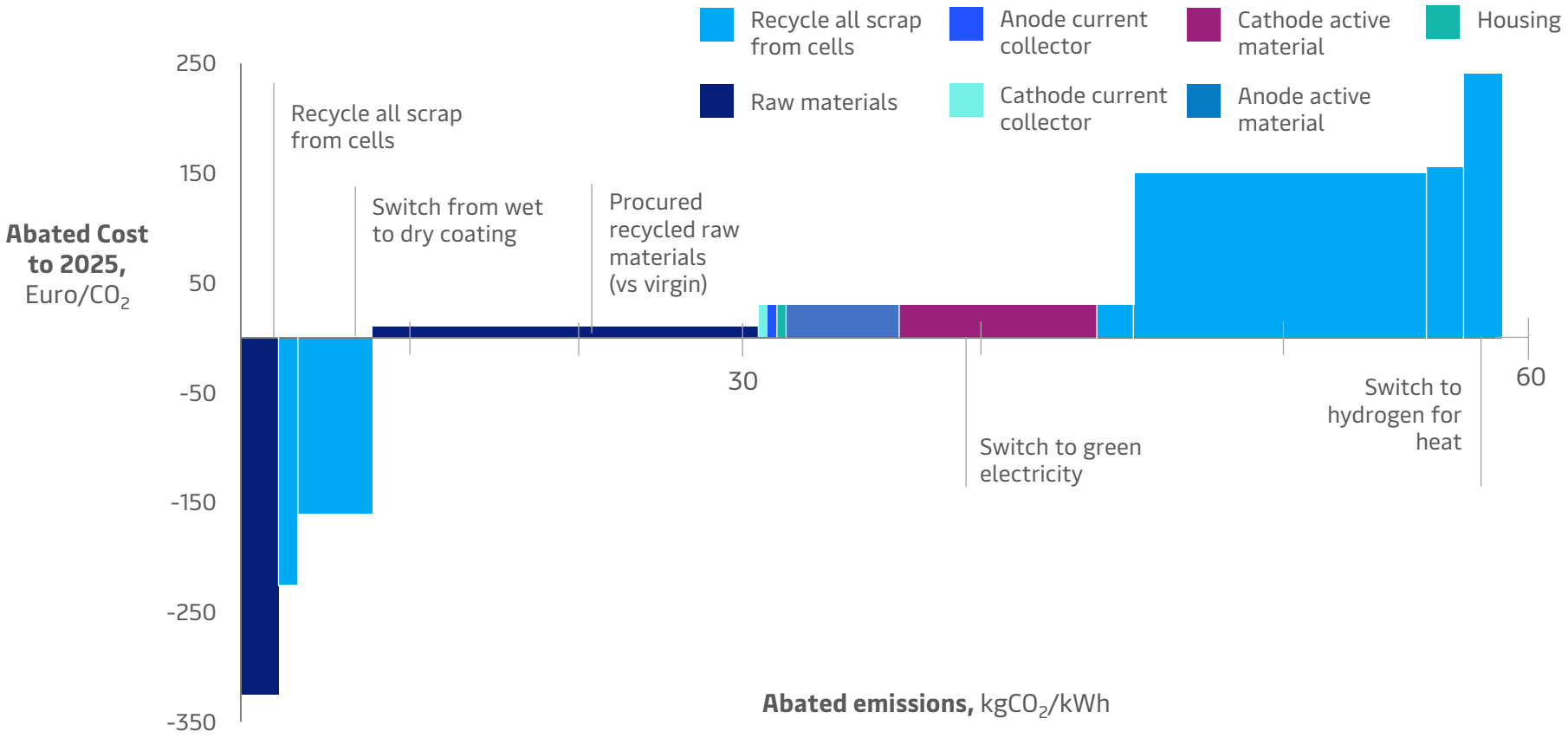
Decarbonization levers for India shall include use of circular materials and low carbon electricity

Carbon abatement possibilities with nickel-manganese – cobalt chemistries of batteries
Abatement levers can be implemented in less than $50



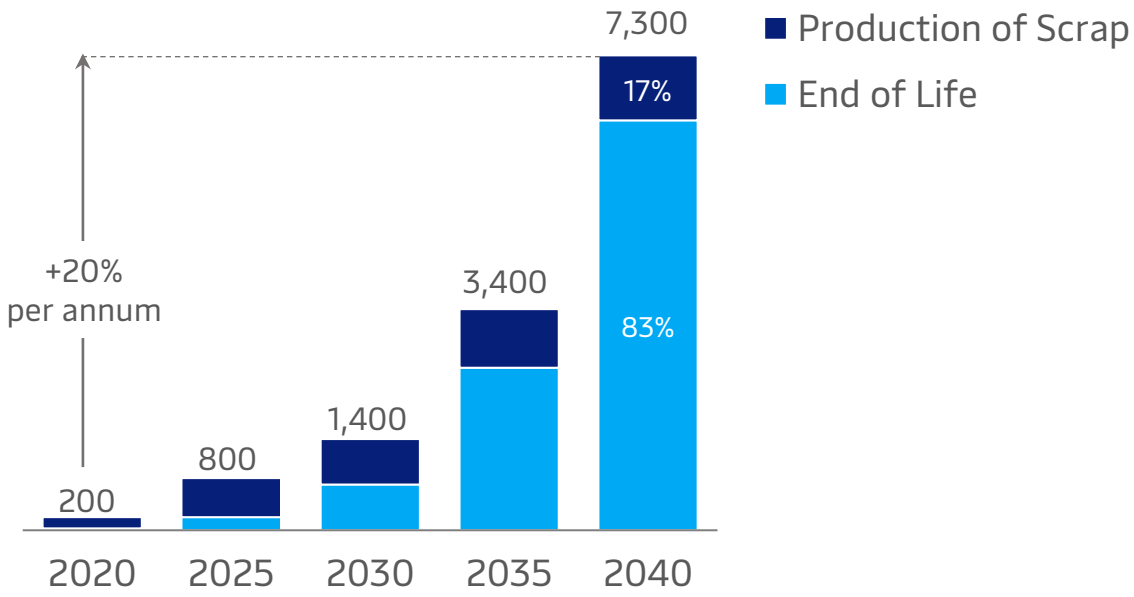
Source: eninrac research, Channel Checks & McKinsey

Battery electric vehicles (BEVs) often are criticized for their GHG emissions and have the said footprints throughout their life. In next 5-7 years some ambitious players across the globe might cut upon the carbon footprints of battery manufacturing, but this would call for comprehensive changes in & across the value chain.

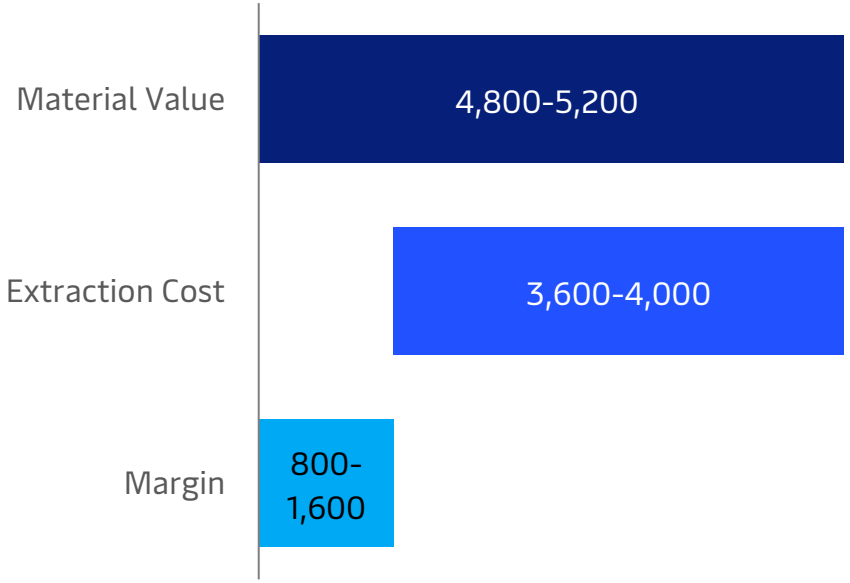
Different tactics can aid abatement. In choice of best possibilities some of these might even result in cost savings, while others would entail heavy expenditures. Under the most beneficial scenarios companies might reduce the footprints by 80 percent at a minimal additional cost as demonstrated in the graphic.

Recycling could offer new possibilities for battery OEMs globally

Available battery material for recycling by source, kt



EV battery recycling economics 2030[1],
$ per ton of battery



[1]Values represent an average across all battery types

Source: eninrac research, Channel Checks & McKinsey

Battery OEMs may find new opportunities in recycling once the market starts maturing. Companies could create a closed-loop, domestic supply-chain that involves collection, recycling, reuse, or repair of li-ion batteries. If only recycling market is to be looked upon it could create a $6Billion market opportunity by 2040 in terms of profit pool and the revenue could be embellished close to $40 billion by that time. This would be a three times quantum jump by 2030. For India, it would be close to $1Billion for profit pool with an anticipated revenue size of $5-6 Billion by 2040. Currently, the recycling models are costly and heavily dependent on multiple factors, including battery designs, process quality, and shifts in market supply or raw-materials demand. In addition, operational challenges such as limited access to battery materials, inefficient processes, and low yields resulting from immature technologies, remain persistent problems in the global recycling sector and shall hold true for India as well. For recycling to gain momentum in India, regulatory support and allied incentive could provide battery OEMs to look to it as a revenue pool with technological R&D being leveraged as well.

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