

Electric Vehicles

Electric Vehicles are the future. The transition away from the Internal Combustion Engine will change the face of the Commodities industry, creating new sources of demand for certain key metals.

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In 2019, Electric Vehicles (EVs) accounted for just 0.5% of the world's vehicles, however by 2025, it's expected that 7% of all passenger vehicles will be electric, rising to 38% by 2040. By 2050, most automobile manufacturers are expected to have gone electric,¹ as governments encourage users to switch away from both the Internal Combustion Engine and hybrid vehicles. The UK government has gone further by announcing a complete ban on ICEs and hybrid cars after 2035.

In common with internal combustion vehicles, EV manufacture uses small quantities of gold and silver quantities in electronic circuit boards. However, EVs use far greater quantities of copper and nickel, as well as metals such as lithium, cobalt and manganese.

Electric cars use twice as much copper as those powered by ICEs while larger vehicles' copper use is even more intensive. Around 22kg of copper is used in an ICE-powered car, 80kg in a battery electric vehicle and 250kg in a battery electric bus.²

Demands for greater vehicle range as well as environmental considerations are bringing about greater nickel use, replacing cobalt and lithium. Battery cathodes with 60% nickel are being replaced by 80% nickel content in order to achieve greater energy density,³ also reducing use of cobalt primarily sourced from the Democratic Republic of Congo. Tesla cars' nickel-cobalt-manganese or nickel-cobalt-aluminium batteries typically account for 30kg of nickel used in the manufacture of a Model 3.⁴

EV Battery Characteristics

Cathode Material	Chemistry	Stability/Safety	Energy Density kWh/kg	Lifetime	Material Cost US\$/kWh	Metal Content kg/kWh		
						Nickel	Cobalt	Lithium
LCO (Lithium Cobalt Oxide)	LiCoO2	Low	High	Poor	High	-	High	Med
NMC (Lithium Nickel Manganese Cobalt)	LiNi _x Co _x Mn _x O ₂ (NMC 111)	Low	Med	Good	Med-high	Med	Med	Med
	LiNi _x Co _x Mn _x O ₂ (NMC 622)	Good	High	Good	Med	High	Med	Med
	LiNi _x Co _x Mn _x O ₂ (NMC 811)	Good	High	Good	Med	High	Low	Med

LMO (Lithium Manganese Oxide)	Li Mn2O3	Very good	Low	Poor	Low	-	-	Med
LFP (Lithium Iron Phosphate)	LiFePO4	Very good	Med	Very good	Low	-	-	Med
NCA (Lithium Nickel Cobalt Aluminium)	LiNiCoAlO2	Med	High	Poor	Med	High	Med	Med

Source:McKinsey, Battery University

Higher quality nickelsulfate has to be used in batteries; this however limits supply as nickelsulfate only accounts for half of total nickel production.⁵ Elon Musk has been widely reported beseeching the mining community to ‘mine more nickel’ in the face of a supply crunch as nickel consumption is expected to increase by more than 50% by 2050.⁶

Footnotes

1. Forbes, July 2019
2. Wood Mackenzie
3. S&P Global Platts
4. CleanTechnica, August 2020
5. S&P Global Platts
6. Reuters, July 2020

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