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Strategic Planning and Market Competition

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Understanding the EV market:

Production Costs and raw material constraints

The average cost of producing an electric vehicle is, on average, higher than those that operate on internal combustion engines. Assuming a comparison between vehicles of similar quality and or purpose, it is noticeable how process is significantly higher.

The higher costs are mostly, not including luxury or high-end details and interiors, due to the cost of producing the battery packs. A battery pack for an EV can cost between \$7,000 and \$10,000 which according to Olyver Wymann (Global consulting Firm), can make for up to 45% increase in production cost compared to a traditional vehicle. That's almost half the cost of an ICE car just for the battery pack.

However, the cost of producing batteries is already coming down, UBS (Multinational investment bank) expects the price of kilowatt hour to drop under \$100 in 2022. In 2020 the average cost of kWh was of \$137. They also expect the extra cost of manufacturing battery electric cars versus their fossil fuel equivalents will diminish to just \$1,900 (£1,470) per car by 2022, and disappear completely by 2024.

The current cost can be explained due to the composition of the battery, the required materials are yet to be used in this industry as massively as fossil fuel, so there's still no room for the benefits of economy of scale. The components of the battery are expensive as explained in an article published by Bloomberg: "The priciest component in each cell is the cathode, one of the two electrodes that store and release a charge. That's because the materials needed in cathodes to pack in more energy are often expensive: metals like cobalt, nickel, lithium and manganese. They need to be mined, processed and converted into high-purity chemical compounds."

There are a few ways to manufacture the batteries with variations on the number of metals used, but all of them are lithium based. The Lithium industry capacity is 450 kt LCE (Kilo Tons of Lithium Carbonate Equivalent), and the current production is well under that limit. The production will keep on growing with the demand posed by the EV market. An analysis by McKinsey shows that the average price of 19,500 USD per ton of 2017 will be reduced to half by 2025.

The industry of Cobalt, one of the most important metals used, is not as big as lithium's. There is some uncertainty around the production of Cobalt. Around 70% of the world's cobalt is mined in the Democratic Republic of Congo, where problems arise often with law and there is also ownership disputes. The messy situation of DRC's cobalt industry also revolves around the social concern of artisanal mines being tied to child labor and inhuman practices. This makes the supply unattractive. Furthermore, cobalt's industry faces a lack of refinery processes and it's a product which depends on nickel and copper, since its not the main metal mined by companies. Volatility is expected, say McKinsey.

A shift to higher nickel to cobalt ratio batteries is expected. Nickel is a metal mainly used in the production of stainless steel, very little is used in the EV industry as of now. The quality of nickel that is to be used for the battery packs is really important, for stainless steel its not. What this means is that mining and refineries don't produce huge amounts of the type of nickel for battery packs since stainless steel manufacturing is flexible on quality. The availability status of high-quality nickel could mean higher prices for the EV market or shortage of material. "Despite being abundant globally, on closer inspection, the world's supply of nickel suitable for batteries may not be as copious as it first appears. As OEMs start to define requirements in relation to the raw materials they use—quality of the nickel, environmental impacts, social concerns, and geographical issues—the size of the pie will suddenly start to diminish and will be different for each OEM, depending on their own requirements and restrictions. Given these uncertainties and risks, certain OEMs might even want to decrease the dependency on nickel", explains McKinsey.

the extra cost of manufacturing battery electric cars versus their fossil fuel equivalents will diminish to just \$1,900 (£1,470) per car by 2022, and disappear completely by 2024, according to research by the investment bank UBS. The research is based on detailed analysis of batteries from the seven largest manufacturers.

UBS said it expected battery costs to drop to below \$100 per kilowatt hour (kWh), a key milestone, by 2022.

The rapid reduction of battery costs is expected to trigger a faster switch to electric vehicles than previously expected. Electric vehicle sales are already booming in the EU and China, despite the hit to the car market caused by the coronavirus pandemic.

<https://www.theguardian.com/environment/2020/oct/21/electric-cars-as-cheap-to-manufacture-as-regular-models-by-2024>

The total cost for manufacturing a compact (C-segment) combustion-engined car is around €13,900. It is divided into €1,600 for assembly, €1,200 for chassis, €1,700 for BiW/exterior, €1,800 for E/E, €2,700 for interior, €2,000 for powertrain/drivetrain, and €3,000 for engine and auxiliary. If you add the numbers, you'll get €14,000, which shows Oliver Wyman rounded some up just to make the graphic easier to read. The same happens with the electric car numbers.

EVs have lower assembly (€1,500) and powertrain/drivetrain (€700) costs. They get even when it relates to interior (€2,700) expenses, and are more costly in chassis (€1,300), BiW/exterior (€2,100), and E/E (€2,000). The E-drive adds €2,000 to the production expenses, and the battery pack – at €8,000 – is the main responsible for the total cost of €20,200 just to get the car ready. That's 45 percent more than the €13,900 for ICE cars.

<https://insideevs.com/news/444542/evs-45-percent-more-expensive-make-ice/>

the average battery cost for a typical electric vehicle works out to about \$7,350

<https://auto.hindustantimes.com/auto/news/why-are-electric-cars-expensive-the-cost-of-making-and-buying-an-ev-explained-41603419957680.html>

Raw Material Constraints

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<https://www.mckinsey.com/industries/metals-and-mining/our-insights/how-clean-can-the-nickel-industry-become>