

Investment Insights

Electric Vehicles — Rising Demand and Relevance



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Highlights

- The electric vehicle market has reached a critical inflection point and should see an accelerating rate of adoption over the next decade.
- The Bessemer public equity and private equity teams own EV supply chain-related businesses such as Aptiv, and battery-related investments such as QuantumScape, respectively. Bessemer external managers have held exposure to EV suppliers and manufacturers such as Cree and Tesla for several years.
- We break down the investment potential for the EV supply chain, consider raw material component inputs, and discuss the potential for traditional OEMs to adapt and compete over the long term.

Overview

The electric vehicle market has been building and evolving for several decades and in our view has reached a critical inflection point. In this Investment Insights, we discuss the electric vehicle market, the transition from internal combustion engine (ICE) vehicles to electric powertrains, key findings on various aspects of the market, and how Bessemer equity portfolios are positioned. Particularly, the discussion will focus on four

key areas associated with electric vehicle production: raw materials, batteries, suppliers, and original equipment manufacturers (OEMs).

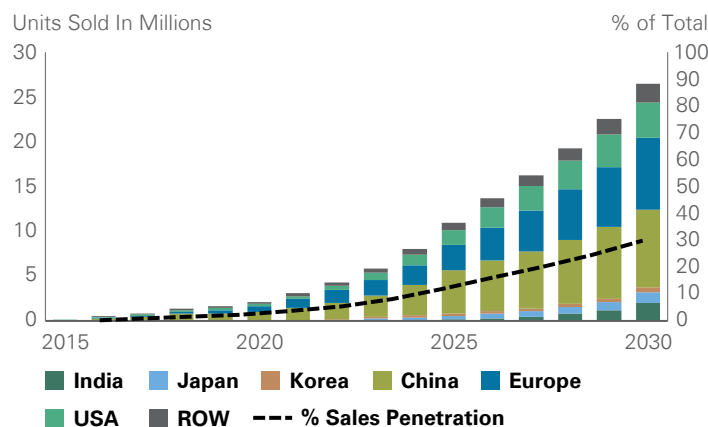
The Electric Vehicle Transition

Battery driven electric vehicles should see an accelerating rate of adoption over the next decade. These cars are expected to seize a third of the market by 2030, up from 3% at the end of 2020 (Exhibit 1). Long-term forecasts expect market share levels in excess of 90% in the passenger and small vehicle market in coming decades.

We believe there are three key factors that are driving the acceleration of electric vehicle adoption: regulatory, economic, and behavioral. First, from a regulatory standpoint, governments globally are setting strict electric vehicle sales and CO₂ emissions targets. Earlier

Exhibit 1: Battery Electric Vehicle Sales by Geography

Key Takeaway: Battery electric vehicle sales could represent a third of new auto sales by the end of the decade.



As of January 2021.

Source: Morgan Stanley

this month, President Biden issued an executive order aimed at making half of all new U.S. vehicles sold in 2030 electric. While individual countries have already enacted similar goals, the European Union recently proposed a full ban of new ICE vehicle sales by 2035. Incumbent OEMs are responding with increased electric vehicle investment, while new electric-only OEMs are emerging, resulting in more innovation and greater selection for consumers.

Second, from an economic standpoint, falling battery prices (the highest cost input in an electric vehicle) and extended driving ranges are also contributing to rising consumer satisfaction with electric vehicles. This is especially important, as the price of electric vehicles compared to equivalent ICE vehicles has been the biggest barrier for consumer adoption, and now electric vehicles are expected to be at cost parity with ICE vehicles in the next two to three years.

Third, from a behavioral standpoint, society's drive for a more sustainable future is aligned with energy transition in the transportation sector. As more people adopt an environmentally conscious outlook, decreasing costs combined with increasing range are motivating consumers to shift toward electric vehicles.

Demand-Driven Supply Gap in Select Commodities

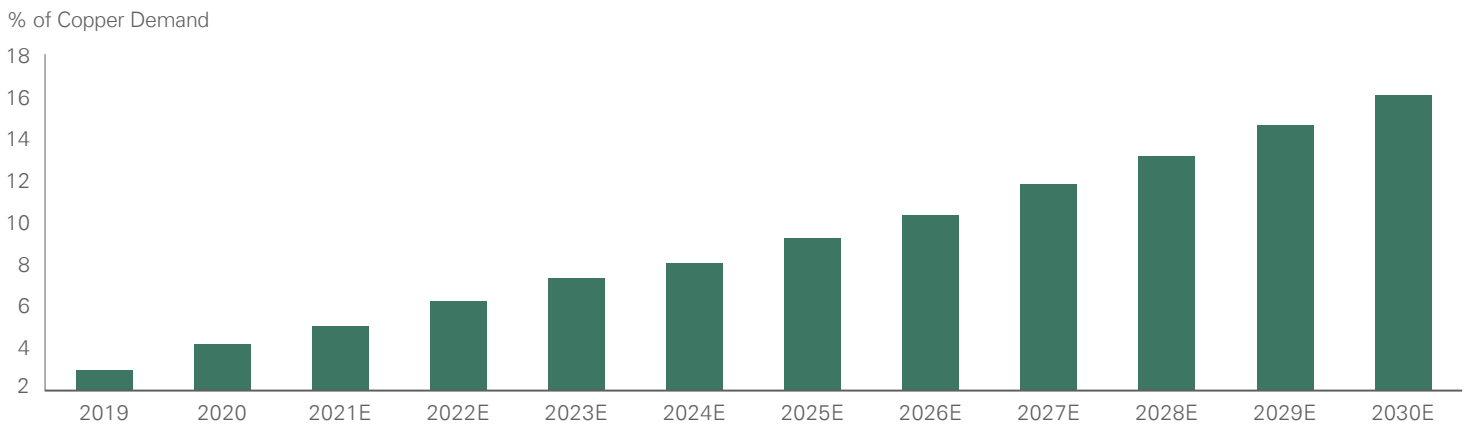
There is an extensive list of raw materials that make up the key inputs in the electric vehicle supply chain — lithium, nickel, and cobalt, to name a few. The Bessemer equity team believes copper has the most attractive fundamental setup. The combination of cyclical and secular growth should support prices and provide long-term support for the shares of select copper miners in coming years.

Copper serves as a key input in various end products in industrial and technology markets. Demand in these areas should support cyclical growth over the next few years as the global economy recovers from the pandemic. Additionally, copper is an increasingly critical input in green markets such as renewable energy, energy storage, and electric vehicles, which collectively are projected to contribute 16% of global copper demand by 2030, up from 3% today (Exhibit 2).

Copper is a meaningful input in the electric vehicle assembly process. It is used throughout the vehicle in the batteries, motors, wiring, and even in the charging infrastructure. As a result, it can be used up to four times as much in a single vehicle compared to use in a typical ICE vehicle, which dominates the road today.

Exhibit 2: Green Demand Is Key Driver of Copper Demand

Key Takeaway: The contribution from green demand is expected to more than triple by 2030.



As of April 2021.

Source: CDA, Goldman Sachs, ICA, IEA, IRENA, Woodmac

As such, we can infer that as the number of electric vehicles on the road rises, so too will the amount of copper needed to support production.

We expect new supply to flow into the market over the next two to three years, but analyst projections reveal a significant supply shortage emerging thereafter and lasting through the rest of the decade, absent incremental production announcements. This forecasted deficit would be more than twice the shortage that was experienced during the commodities super cycle leading up to the 2008 financial crisis (Exhibit 3).

Prices collapsed in 2014–2015 as Chinese demand started to slow and the world went into an industrial recession. Copper miners have been wary about making growth investments ever since. Instead, they have been focused on cleaning up their balance sheets and improving capital allocation to be more shareholder friendly.

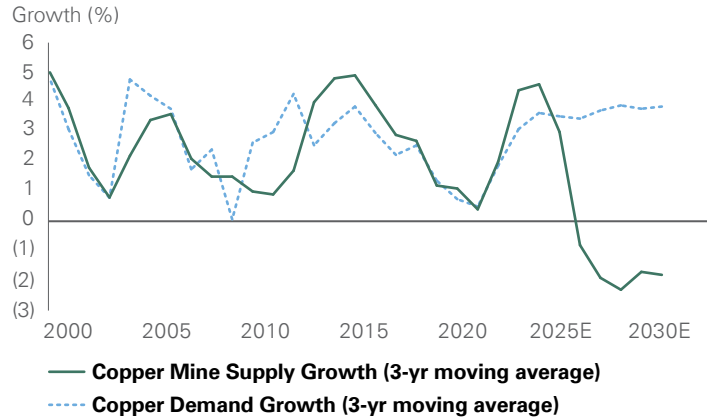
Reverting to a growth orientation is not as easy as reallocating cash flow to growth capital expenditures. New mine projects are getting more difficult to undertake today compared to 10 years ago, as a more environmentally conscious society is resulting in more regulation and a slower permitting process worldwide. A new mine today can take four to six years to come online from the point when ground is initially broken.

Importantly, electric vehicles are not going to be the only sources of demand for new copper. Solar power, wind power, battery storage, and charging infrastructure are all expected to be notable sources of new copper demand. Therefore, despite copper prices rising approximately 90% from their Covid-19 lows, as of this writing, it may be necessary for prices to move even higher to incentivize new growth investment.

Evaluating this from a portfolio construction standpoint, the Bessemer equity portfolio management team continues to emphasize quality as a key investment criterion for all internally managed strategies. While the commodity space does not often align with the quality metrics the team evaluates due to profit and cash flow volatility, the multiyear fundamental setup in copper discussed above, with its leverage to secular growth in green markets, underpins the team's investment in Freeport-McMoRan.

Exhibit 3: Copper Supply vs. Demand Growth

Key Takeaway: Demand outpacing supply by mid-decade should support copper prices.



As of April 2021.

Source: CDA, Goldman Sachs, ICA, IEA, IRENA, Woodmac

Battery: Critical Enabler but Evolving Landscape

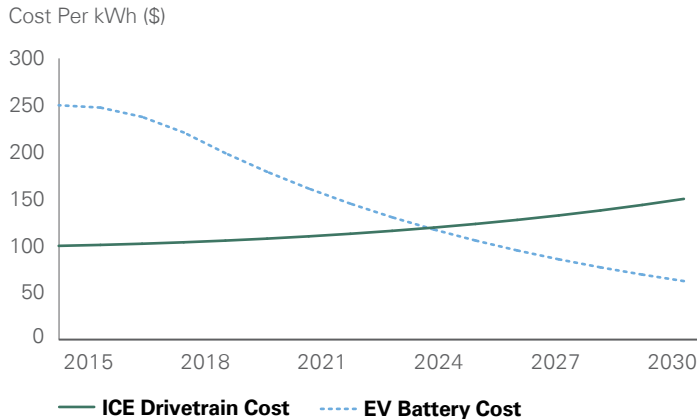
Batteries are a critical component of electric vehicles, typically making up 30% to 50% of total vehicle cost. Historically, battery costs were even higher, creating a headwind to adoption as the cars were too expensive for the mass market. In recent years, however, battery costs have been declining rapidly, falling more than 60% since 2013. Increasing economies of scale and incremental innovation in battery chemistry have allowed this trend of unit cost improvement to continue.

As can be seen in Exhibit 4, electric vehicles are now expected to reach cost parity with ICE vehicles in the 2023–2024 time period. Moreover, while electric vehicle costs are falling, costs of ICE vehicles are rising due to increased costs to comply with stricter emission standards. These economic dynamics have served as a tailwind to electric vehicle adoption and should strengthen further in coming years.

The Bessemer equity portfolio management team evaluated whether the battery portion of the electric vehicle value chain is attractive. The team

Exhibit 4: Electric Battery Costs Decline While ICE Drivetrain Costs Rise

Key Takeaway: EV battery costs reach parity with ICE drivetrain costs in 2023–2024 time frame.



As of June 2021.

Source: Morgan Stanley

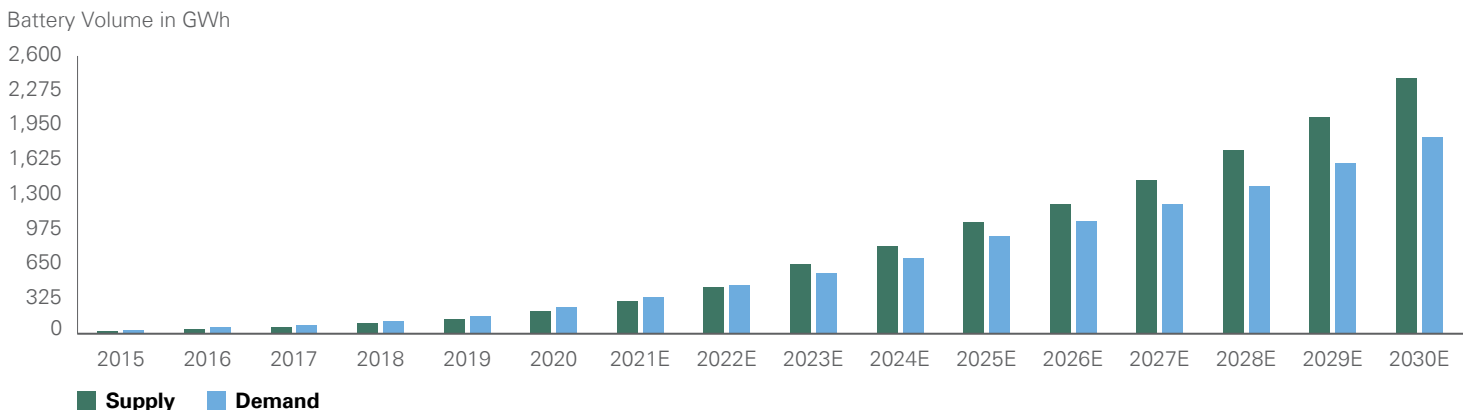
concluded that while the industry has some attractive characteristics, the competitive landscape is still evolving rapidly.

One attractive quality is that this is a consolidated industry, with a handful of companies controlling the majority of battery supply today. As an example, Contemporary Amperex Technology Co., a China-based company, has 50% market share of batteries sold to Chinese electric vehicle companies. An additional attractive quality is the presence of technological barriers to entry as companies have spent significant capital on research and development and have created intellectual property. Lastly, there is a heavy manufacturing component inherent in the battery industry that makes scale important while at the same time creates barriers to entry for new entrants.

Due to the rising long-term demand forecasts for electric vehicles, the battery industry had expected a long-term undersupply challenge, but forecasts have now been revised toward oversupply, as shown in Exhibit 5. The change in forecast is a result of large automotive OEMs such as Tesla, General Motors, and Volkswagen responding to expected undersupply forecasts with announcements of intentions to insource battery manufacturing — in part to secure supply. There is also some industry speculation about whether a company such as Tesla could become a battery supplier to other electric vehicle companies longer term.

Exhibit 5: Global Battery Supply vs. Demand

Key Takeaway: Battery industry expected to be in an oversupply situation following the announcement of OEM insourcing.



As of June 2021.

Source: Morgan Stanley

The Bessemer equity team investigated whether any of the battery suppliers could have durable competitive advantages. Initial findings indicate that battery suppliers are not likely to have a durable competitive advantage on the technology side or as it relates to costs. Some suppliers may have first-mover advantages, but the team does not expect them to be durable. As an example, Tesla believes the advantages as they relate to battery supply will come from the software used to manage the battery, as opposed to the battery itself. Overall, the team concluded that the battery portion of the value chain has an evolving competitive landscape, which leads the team to have low conviction in the path for long-term return on invested capital for this capital-intensive industry.

Increased Revenue Opportunity Per Vehicle for Select Suppliers

There are certain component suppliers that the Bessemer equity team believes are well positioned to benefit from the shift to electric vehicles, including certain semiconductors and electrical content providers. These businesses tend to benefit from high switching costs and incumbency advantages. They engage with OEMs early in the design process and get specified within the production schematics for given model types. As such, it is highly unlikely that they are replaced over the life of the vehicle. Those suppliers that are best positioned offer critical, non-substitutable inputs. OEMs also prefer to buy rather than build these components, as the suppliers' economies of scale can get passed on to the OEMs in the form of lower unit costs when compared to producing internally.

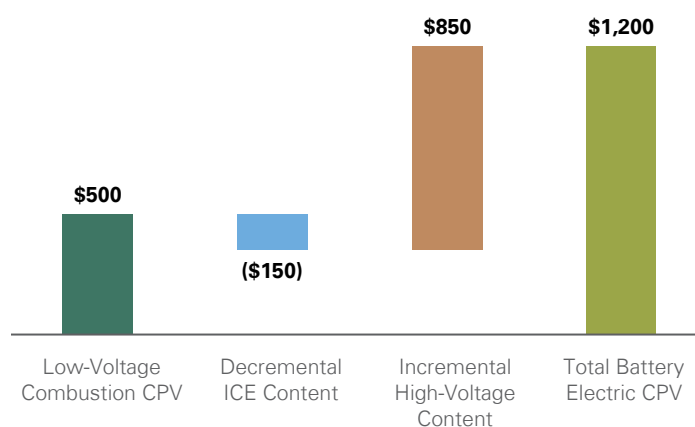
The shift to electric vehicles is changing the relative functional and economic value of components. Semiconductor content per vehicle (CPV), specifically, is expected to triple in electric vehicles compared to their ICE predecessors. Power semiconductors are the most direct beneficiaries, as inverters manage electricity distribution from the motor. High-voltage electric vehicles distribute hundreds of volts (V) of electricity compared to today's 12V ICE vehicles, making effective electricity management all the more important. This not only results in more power management CPV, but

it also increases the value of that supplier to its OEM partner, driving even greater stickiness. Higher analog power management content is one growth driver for Texas Instruments, a Bessemer holding.

Certain electrical content providers are also bringing more functional and strategic value to their OEM partners. In order to safely and effectively distribute such high voltage, the cabling, wiring, and component content in electric vehicles must be thicker, heavier, and denser. Correspondingly, as shown in Exhibit 6, the addressable content per electric vehicle is twice that of its low-voltage combustion counterpart. Naturally, this incremental content adds mass and weight, both detrimental to energy efficiency. When combined with already heavier engines (electric motors can be three times the weight of ICE given the weight of the battery), optimizing the electrical architecture becomes essential for OEMs. We believe that electrical content suppliers that can offer holistic electrical architecture expertise and product, such as Aptiv PLC (a Bessemer holding), are poised to increase content share in this environment. Aptiv's relationship with Tesla serves as an excellent case study on this dynamic. In Tesla's original Model S, Aptiv had ~10% share of the ~\$1,000 of electrical CPV. However,

Exhibit 6: Aptiv Total Addressable Content Per Vehicle

Key Takeaway: We believe Aptiv has the opportunity to more than double its revenue per vehicle as the market transitions to electric vehicles.



As of June 2021.

Source: Aptiv investor presentation

the value of the company's holistic electrical architecture expertise was then reflected in materially higher share, to over 50% of CPV, in the subsequent Models 3 and Y.

OEMs

OEMs that have ambitions to move to a fully electric fleet, like a Volvo (2030), or a GM (2035), have stated their intent to be more vertically integrated. This means bringing the core functions of an electric vehicle in house, which include battery production, electrical architecture, connectivity, and software. Additionally, these players are committing to a dedicated manufacturing platform solely for electric vehicles. Some of them are partnering with top suppliers to, in many cases, build plants jointly, with the OEMs maintaining control over operations. This enables them not only to share the investment burden, but also gain expertise they don't currently have.

Historically, high fixed costs of design and manufacturing plus economies of scale gained from mass auto production made it difficult for start-ups to enter. But today, access to financing is abundant, and roughly 100 electric vehicle-related start-ups and a dozen OEM challengers have received funding at high valuations or gone public via SPACs over the past year.

Similar to challengers, incumbent OEMs see electric vehicles as a springboard toward potential success in other adjacent areas including commercial hardware, connected mobility services, and autonomous driving features. If adjacent areas are pursued and achieved successfully, this would result in a more lucrative OEM business model that not only manufactures vehicles more efficiently but also generates profits across a vehicle's entire life cycle versus the single transaction it is today. In fact, OEM electric vehicle spending has recently been rewarded by the market through multiple expansions, which means electric vehicle investment is viewed as increasing terminal value, not destroying it.

Bessemer portfolios currently do not own any OEMs, as it is still early to determine what success will look like. However, the team is encouraged by the opportunity OEMs have to improve operations and their environmental ratings as the transition to electric vehicles takes shape. The team continues to monitor for opportunities around electric vehicle adjacencies that would further unlock value for these businesses.

Conclusion

Overall, we expect to see accelerating adoption of electric vehicles over the coming decade, owing to regulatory, economic, and behavioral tailwinds. OEMs, new and old, are responding with materially increased investment, which will result in a proliferation of model types and thereby, consumer choice. Our analysis to date suggests that auto suppliers with core competencies crucial to the performance of electric vehicles will see their revenue opportunity per vehicle increase substantially in this new world. Within raw materials, copper presents a favorable supply-demand dynamic owing to both cyclical and secular factors, and therefore we see select copper companies as offering the most attractive investment opportunities within the raw materials space. Other layers of the value chain, on the other hand, are less certain. The battery portion of the supply chain is capital intensive in nature, and the team has not found long-term durable investment opportunities here to date. The future of OEM business models remains uncertain; however, the team continues to monitor the space for additional investment opportunities.

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