INVESTMENT UPDATE
May 23, 2018

Trends: Automobile Industry & the Electric Vehicle Revolution

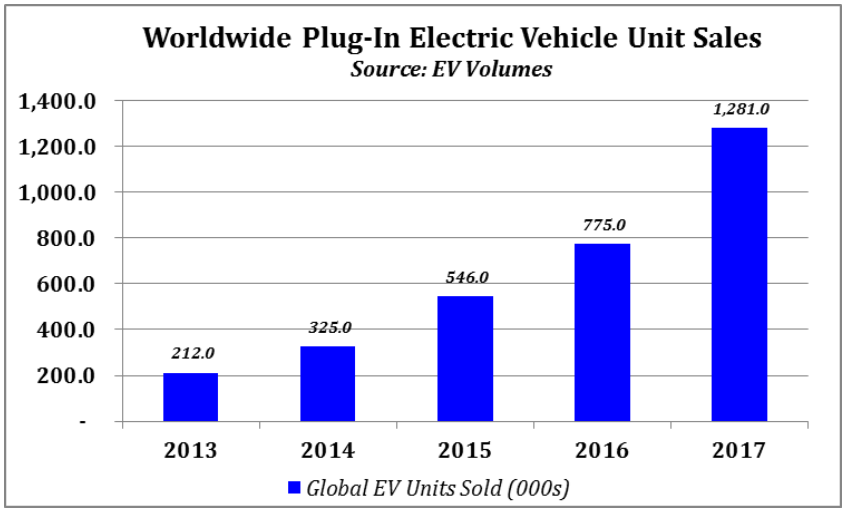
This piece is the first in a series of occasional memos to inform our clients of transformative, long-term (secular) themes that we examine as part of our investment process. A secular theme typically starts as a subtle change within a market that gradually gains momentum and plays out over an extended period of time, perhaps decades (think ecommerce, mobile computing, and clean energy). We study these trends and the companies that have specific exposure to these themes for potential investment opportunities.

The growth of the global automobile industry over the past century has been intrinsically tied to the internal combustion engine. Rapid advances in battery technology represent a sea change for the industry that has fueled the accelerating global rollout of electrified vehicles that will displace demand for conventional vehicles. The electrification of vehicles, both passenger and commercial, is a game changer that will disrupt the staid industry. Traditional manufacturers, suppliers, and distributors will be forced to confront the new electric car reality and the different competitors, economics, and regulations that accompany it. If done right, this important shift can have a significant positive effect on carbon emissions.

The Growth Ahead

Electric vehicles, which include 100% battery-powered vehicles as well as plug-in hybrids that rely on electric power first before a combustion engine is engaged, have grown from nearly 50,000 sold globally in 2011 to over 1 million last year. While that growth is impressive, they remain a tiny portion of total vehicles sold worldwide (roughly 1% in 2017). Gasoline-powered vehicles, unsurprisingly, remain kings of the road … for the time being. As with any secular trend the runway for electric cars is quite long. Various auto industry experts predict that the number of electric vehicles sold across the globe will outnumber traditional vehicles around 2030 which, if true, implies a 50-fold increase in the number of battery-powered cars/trucks/buses sold annually.

The Road to Mass Adoption



Multiple factors will help drive the mass adoption of battery-powered autos over the coming years. Led by significant improvements in battery design and composition, new generation batteries will allow these vehicles to cover greater distances on fully charged batteries and cost manufacturers much less to produce. As battery prices fall, the cost of ownership will become increasingly attractive to buyers, especially when compared to traditional gasoline-powered offerings – affordability is a critical driver to alternative vehicle ownership. In addition, increased regulatory oversight relating to carbon emissions and fuel economy will continue to present new challenges (and costs) to traditional vehicle manufacturers. Some federal authorities are going so far as to push for the elimination of fossil fuel–powered auto sales altogether; recently China, France, India, the Netherlands, Norway, and the UK all committed to take such action in the coming years. Perhaps the most important driver of the rise of electric cars, however, is the role that traditional automakers are playing. Most of these automakers have embraced the electrification opportunity by introducing new models and/or expanding their offerings beyond a limited number of models like the Chevy Bolt, the Nissan Leaf and the BMW i3. Consumer interest will certainly rise as choices broaden; according to the *Financial Times*, the number of electric-powered models available globally will rise from 112 in 2017 to 184 this year. The road to mass

adoption of electric vehicles, however, does face various headwinds. Among these hurdles are insufficient battery range, limited charging station infrastructure, the extended time needed to complete a full charge, and any potential elongated period of downward pressure on oil prices in the future.

Finding Investment Opportunities

As we consider investable opportunities relating to this secular theme, our investment process attempts to go beyond the obvious. While there will be winners and losers among the traditional automakers as they expand into electric offerings, new competitors, like Tesla, will continue to carve out sizable niches in the growing market. But the electric vehicle revolution is a global phenomenon and stretches well beyond US borders; China, for instance, is home to both the world's largest electric car market and a handful of pioneers in battery-powered vehicle production. The biggest opportunity, however, lies outside of the car makers themselves and in the burgeoning supply chain for this nascent industry. Makers of batteries, specialized technological components, power management systems, and wiring are among some of the players that will benefit from the electric vehicle wave. Outside of direct suppliers there are companies that produce charging infrastructure and battery recycling capabilities that will provide critically important services to the industry. We currently have exposure to this important theme in different ways, but continue to monitor all of these aspects for additional opportunities.

ESG Considerations and Electric Vehicles

From an ESG perspective, we focus on both the promise and the potential risks associated with electrification. Companies across this industry stand to benefit from and enable a worldwide transition to low-carbon energy alternatives and sustainable transit. Various companies appear poised to capitalize on the ambitious near-term goals for electrification that may play out as governments around the world turn to these technologies to help implement the Paris Climate Accord. However, the same companies have faced social issues that will need to be monitored closely. These include the challenge of promoting worker safety and suitable labor standards in factories and extensive sourcing networks throughout the globe. More widely, battery makers, automakers, and electric vehicle companies alike are affected by a risky supply chain for the basic materials that enable advanced batteries. According to global risk consultant Verisk Maplecroft, "seven of the primary raw materials in lithium-ion batteries – cobalt, lithium, copper, manganese, nickel, graphite and bauxite" are "high-risk" for human rights and forced labor. Amnesty International has flagged the cobalt supply chain and called out various companies for not doing enough to ensure their sources do not fund conflict and abuse in areas such as the Democratic Republic of Congo. To respond to manufacturing issues, as well as the deep supply chain, we look for companies that have clear labor rights policies, make reasonable efforts to report on worker safety, and take steps with peers to enable traceability and responsibility in the supply chain for essential commodities.

As with any mega-trend, patience is required. The adoption of electric vehicles throughout the auto industry is no different. We believe that the demand for alternative vehicles will continue to grow apace. Traditional business models will be pressured and new winners will emerge that we hope to include in client portfolios. As we carefully consider secular trends and the social ramifications as part of our investment process, we will continue to look closely at the electric vehicle space for investable opportunities.

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