Global Companies Driving Robust Electric Vehicle Adoption

Key Takeaways

- As predicted in our 2016 white paper, consensus expectations for EV sales have been too low: we suspect EV sales forecasts will continue to be revised upward.
- As batteries become cheaper and more powerful and demand rises, deployment of electric city buses, delivery vans and utility vehicles should also continue to grow.
- In the coming years, much of the value in EVs will be in software, battery components and semiconductors, technologies dominated by companies outside of the traditional auto supply chain.

In a 2016 white paper, we discussed the electric vehicle (EV) market and argued that EV sales had the potential to grow much faster than many assumed. We explored the key advantages an EV powertrain offers compared to the internal combustion engine (ICE) drivetrain: it can deliver better performance due to the instant torque of the electric motor, it is cheaper to charge due to higher energy efficiency and, with fewer moving mechanical parts, it has much lower maintenance costs. We also argued that, as battery costs continued to decline, manufacturers would be able to offer competitive EVs in a growing number of market segments. Given the speed of improvement in lithium-ion battery technology, we argued consensus expectations for EV sales were too low.

As we predicted, sales have grown faster than expected and the outlook for EV production has become more optimistic (Exhibits 1 and 2). Between 2015 and 2017, EV sales expanded at a consolidated annual growth rate of over 50% globally and reached 1.1 million in 2017. The International Energy Agency (IEA) now predicts that the global EV stock will reach 130 million vehicles in 2030, up significantly from its 58 million “base case” forecast published in 2017. We suspect these forecasts will continue to be revised upward in the future.
Here we show how electric city buses, delivery vans and utility vehicles have also witnessed strong growth and should continue to grow as batteries become cheaper and more powerful and demand rises. Strong EV growth in all these areas should also lead to opportunities in several new areas — in parts, materials and adjacent industries, for example — as the rate of disruption and innovation increases.

**Electrification of Buses and Truck Will Likely Accelerate**

More and more buses on the road are electric. There were approximately 386,000 electric buses in use globally in 2017, up from only 146,000 in 2015, according to Bloomberg New Energy Finance (BNEF). Nearly all of these are in China: in the last three years, the growth in e-buses globally was mostly driven by environmental concerns and large Chinese subsidies. In cities such as Shenzhen, Beijing and Tianjin, subsidies brought the purchase price of battery electric (BEV) buses within the range of conventional buses. By the end of 2017, Shenzhen had completely transformed its urban fleet of 16,359 buses to all-electric models and is now targeting its taxi fleet. In addition, the Chinese fleet of BEV and plug-in hybrid electric (PHEV) buses accounted for almost all 386,000 units in use globally.

As battery costs continue to decline, the purchase of an e-bus will become an economically justifiable decision, even without subsidies. E-buses have much lower operating costs and are already cheaper on a total cost of ownership basis than conventional buses in some regions. According to the IEA, e-buses traveling 40,000 km to 50,000 km per year are already cost competitive in regions with high diesel taxation like Europe as long as battery prices are below $260 per kilowatt hour (kWh). To alleviate the higher up-front purchase price of e-buses, new business models are also evolving, including battery leasing, joint procurement and bus sharing.

We expect adoption of e-buses to accelerate as economic benefits become more evident in various regions. Several cities, especially in China and Europe, have already announced ambitious electrification plans for their municipal fleets. In October 2017, 12 cities signed the C40 Fossil-Fuel-Free Streets Declaration, pledging to procure only zero-emission buses from 2025 onward. Oslo plans to transition to an all-renewable fleet in 2025–2030.

The electric powertrain is also expected to be adopted across various commercial truck platforms, something not in mainstream forecasts two years ago. This is significant because trucks are large consumers of diesel fuel due to their high weight and mileage driven. So far, most of the plug-in electric models introduced are light- and medium-freight trucks that operate in urban and suburban contexts. Currently the largest market for e-trucks is China, where companies like Chinese vehicle manufacturer BYD offer electric utility trucks for municipalities. In Europe, StreetScooter, owned by DHL,
manufactures electric vans that have been delivered for the German post office.

As total costs of ownership decrease, a growing number of electric heavy-duty truck models have also been developed for pilot projects (Exhibit 3). Tesla has announced its Semi model and Daimler has announced series production of its heavy-duty truck as of 2021. According to Tesla, due to lower electricity costs and fewer systems to maintain, its Semi will provide $200,000 in annual fuel savings and a two-year payback period.

Source: ClearBridge Investments, company announcements.
Battery Costs Falling Rapidly

The falling cost of rechargeable batteries is a key premise for our view that EVs will be increasingly disruptive to traditional ICE platforms. As batteries get cheaper, auto makers can offer cheaper and better EVs. The weighted average price of lithium-ion battery packs saw a 24% year-over-year decline in 2017 to $209/kWh, according to a recent BNEF survey of 50 companies across the value chain. Battery costs have improved by around 80% since 2010. BNEF observed that these price reductions are largely a result of an increase in battery manufacturing capacity and the economies of scale that come with it (Exhibit 4). Battery costs will continue to improve, mostly due to changes in the number and scale of battery factories, size of batteries installed in cars and improving battery chemistry.

As costs come down, EV battery production capacity is rising quickly. Total commissioned EV lithium-ion battery production capacity was 131 gigawatt hours (GWh) in the first quarter of 2018, a 46% increase from 90 GWh a year earlier. If all the lithium-ion battery capacity announced and under construction is built, global manufacturing capacity will increase to 406 GWh by the end of 2021. As industry players commission larger manufacturing plants, economies of scale remain an important driver of lithium-ion battery price reductions.

While Tesla does not provide its current cost of batteries, it has said publicly that it expects its battery pack costs to decline to around $100/kWh by 2020. We expect Tesla to be significantly ahead on unit battery costs versus other car manufacturers, as Tesla benefits from large economies of scale at its Gigafactory in Nevada, from its large battery size per car (lowering the battery pack costs per kWh) and from its relatively high car manufacturing volumes, especially with the recently launched Model 3.

EV Demand Shifting from Regulatory Push to Demand Pull

Many original obstacles to EV adoption, such as cost, range and charging infrastructure are gradually being overcome. Many original equipment manufacturers (OEMs) are moving away from compliance EV cars to embrace the technology and are offering fast and attractive long-range cars. Historically, there has been a perception that EVs are of lower quality than their ICE counterparts. This may have been true as electric powertrains were often forced into chassis designed to house combustion engines. However, a new generation of modular vehicle platforms, designed from the ground up as EVs, should address these concerns. Volkswagen, for example, is working on a new EV platform called MEB. This platform has been specifically developed to make the manufacture of EVs more efficient and therefore less expensive. Its design starts with a flat-shaped battery and allows for a flat floor and a roomier-than-normal cabin. Volkswagen intends to leverage this
platform over several different EV models to improve the economies of production.

The premium end of the market will soon see several new attractive EV models. After Tesla’s S and X models captured significant premium segment market share, competitors responded by announcing many attractive electric models. These include cars such as the Porsche Taycan, Audi e-tron, Mercedes EQC and Jaguar I-PACE, which is already available in Europe. These new premium cars promise good driving ranges, fast charging capabilities and attractive specifications, such as good handling and quick acceleration.

Early indications are that Tesla’s Model 3 will be a major commercial success. In the U.S., with sales of 14,000 units in July 2018, according to preliminary data, the Model 3 outsold its top four category competitors combined (BMW 3, Mercedes S, Audi A4 and Lexus IS). Initial Model 3 reviews tout superior handling, acceleration and quietness unmatched by the ICE platforms at similar prices. Interestingly, customer surveys regarding EV purchase intentions are generally positive and most new electric models have long waiting times as demand has outstripped OEM projections. Automakers have made significant commitments to electrification in the past year, with announcements ranging from setting specific EV sales targets over the coming decade (Exhibit 5) to developing new vehicle architectures and ramping up spending in R&D and equipment.

The growth in public charging infrastructure has been impressive over the last two years. There are also many initiatives underway to grow the networks further. Tesla has its Supercharger network, and IONITY, owned by a consortium of Western OEMs, has plans for 400 fast charging stations in Europe. Meanwhile, companies such as ChargePoint and EVgo already operate public and private charge points. Electrify America has committed $2 billion to develop a fast charging network in the U.S. While currently EVs are charged mostly at home or at certain destinations, ultimately strong public charging infrastructure along highways will be critical to wide EV adoption.

**Electrification Continues to Create New Growth Opportunities**

Electrification will affect many industries and companies. Electrically powered components have fewer moving parts, are easier to build and in some cases last longer. Items like engine parts, oil filters, intercoolers, turbos and other ICE-related products may face declining growth rates in the future, depending on EV adoption curves. Electric powertrain components are joined by advanced power management systems that heavily depend on software and semiconductors. Right now, a lot of value of each vehicle is in parts that might simply disappear from cars in the future. In the coming years, much of the value in vehicles will be in software, batteries and semiconductors — technologies
dominated by companies outside of the traditional automotive supply chain.

The shift to fully electric cars presents a good opportunity for the semiconductor industry. Research estimates the semiconductor content in the Tesla Model 3 to be above $1,500 compared to the roughly $400 in an average ICE car. Much of this is in powertrain semiconductor modules, such as the inverter module and battery monitoring boards. Model 3 powertrain semiconductor content is estimated to be worth around $600, or about six times more than in an average car. The key suppliers of powertrain semiconductors in Europe are STMicroelectronics and Infineon.

The whole supply chain for rechargeable batteries will have to scale up massively. We are already witnessing large expansion projects shaping up. In the lithium market, all key players reported growth in demand from EVs and announced massive capacity expansions. According to Volkswagen and Albemarle, a lead producer of lithium for EV batteries, annual sales of 3 million EVs will require some 140 million tons of lithium carbonate equivalent, more than double the current demand for lithium from the consumer electronics industry. Albemarle expects the lithium market to almost quadruple by 2025. Its Chilean peer Sociedad Quimica y Minera (SQM) announced plans to increase lithium carbonate capacity fourfold to 180 million tons by 2021.

Leaders in cathode materials, a key component of the rechargeable battery, also expect substantial growth in demand. Umicore, from Belgium, expects the rechargeable battery market to increase more than tenfold to 650 GWh from 2015 to 2025. This positive outlook, based on the manufacturing pipelines of EV and e-bus manufacturers, drives Umicore’s plan to quadruple its manufacturing capacity for battery cathode materials.

EVs will also offer new opportunities for companies that did not have material exposure to the car powertrain previously. Nidec from Japan, for example, is leveraging its expertise in electric motors to capitalize on the growth of electric traction motors. Nidec announced plans to build several factories to manufacture electric traction motors for cars and buses and targets at least $1 billion in revenue by 2025 from these products. While many OEMs will manufacture electric traction motors in-house, Nidec estimates that around half of electric motors manufacturing volume will be outsourced to specialized companies like itself.

**Conclusion**

We continue to explore new growth opportunities created by increasing EV adoption. As batteries become cheaper and more powerful, adoption should only increase, and EV powertrains should become more feasible in a variety of EV vehicle types. We are also exploring opportunities resulting from the shift in value in vehicles from traditional auto parts to software and semiconductors, technologies traditionally outside the automotive supply chain. This shift looks poised to continue as a new generation of modular vehicle platforms, designed from the ground up as EVs, generates increased demand.

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- 22 years of investment industry experience
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