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Tesla, Inc.

*When Henry Ford made cheap, reliable cars, people said, "Nah, what's wrong with a horse?"
That was a huge bet he made, and it worked.*

– Elon Musk¹

January 7, 2020. Shanghai, China. Just one year after Elon Musk with a cadre of high-ranking Chinese officials broke ground on a dirt field near Shanghai China to commence the building of Gigafactory 3, Tesla's CEO was now dancing on stage to celebrate the first deliveries of locally made Model 3s.

Tesla's stock market valuation crossed the \$150 billion threshold.² This made the electric vehicle startup more valuable than GM, Ford, and Chrysler combined and the second most valuable auto company globally, only behind Toyota Motor Corp.—but ahead of the Volkswagen Group, the world's two largest car manufacturers. To put Tesla's stock market valuation in perspective, in 2019, GM and Ford combined made more than 10 million vehicles while Toyota and Volkswagen each made over 10 million. In comparison, Tesla made less than 370,000 cars.

Just a few months earlier, in the summer of 2019, Tesla's market cap hit a low point of \$32 billion. Back then, as the company was trying to scale-up production of the Model 3 to meet demand, many had speculated that the company would soon run out of cash because it kept missing delivery deadlines and was mired in "production hell" (as CEO Elon Musk put it).³

After the raucous delivery party in Tesla's brand-new Shanghai Gigafactory, Elon Musk sat back and relaxed as the private jet took off. As the Gulfstream G700 gained altitude, Elon was trying to catch up on his sleep, but a couple of things kept him awake. In particular, the Tesla CEO worried about how the company would continue to scale-up production profitably, while also launching several new models. Later in 2020, Tesla plans the delivery of its Model Y, a smaller compact sport utility vehicle (SUV). And in 2021, Musk promises the first deliveries of the futuristic pickup truck—the Cybertruck. Although Elon Musk was happy that Tesla beat expectations in 2019 by delivering 367,500 vehicles (**Exhibit 1**), for 2020 he promises delivery of over 500,000 vehicles.

Perhaps, even more important, Elon Musk worried about future demand in the company's three key markets: the United States, China, and Europe. Even if Tesla succeeded to ramp up production, will there be sufficient

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demand? How could the electric vehicle (EV) company grow production by more than 35 percent while being profitable? Although Tesla had some profitable quarters in the recent past, on an annual basis, the company is yet to make a profit (**Exhibit 2**). Federal tax credits in the United States for Tesla vehicles have ended, while China is also reducing tax incentives for electric vehicles. In the meantime, his phone kept buzzing with reports of some kind of new coronavirus causing flu-like symptoms and pneumonia, with adverse repercussions on Tesla's supply chain and its new Gigafactory in Shanghai.

Another issue that troubled Musk, and which leads him to tweet often directly with disgruntled customers, is the perception that although Tesla styles itself as a luxury car brand, its delivery experience, and customer service is not up to par. Given a large number of deliveries of Model 3s in the United States during the second half of 2019, Tesla's customer service bandwidth and capabilities had yet to catch up. The EV-company began to develop a reputation, at least in the United States, for launching innovative and paradigm-defining vehicles. Yet at the same time, many Tesla owners and observers considered its customer service inferior.

As Musk grabbed a low-carb Monster energy drink from the fridge in his airplane suite, he booted up his Lenovo laptop, and began to organize his thoughts ...

Elon Musk: Engineer Entrepreneur Extraordinaire

In 1989, at the age of 17, Elon Musk left his native South Africa to avoid being conscripted into the army. Says Musk, "I don't have an issue with serving in the military per se but serving in the South African army suppressing black people just didn't seem like a really good way to spend time."⁴ He went to Canada and subsequently enrolled at Queen's University in 1990. After receiving a scholarship, Musk transferred to the University of Pennsylvania. He graduated in 1995 with bachelor's degrees in both economics and physics, and he then moved to California to pursue a Ph.D. in applied physics and material sciences at Stanford University.⁵

After only two days, Musk left graduate school to start Zip2, an online provider of content publishing software for news organizations, with his brother, Kimbal Musk. Four years later, in 1999, computer-maker Compaq acquired Zip2 for \$341 million (and was, in turn, acquired by HP in 2002). Elon Musk then moved on to co-found PayPal, an online payment processor. In 2002, eBay acquired PayPal for \$1.5 billion, netting Musk an estimated \$160 million.

Elon Musk is widely viewed as the world's premier innovator, bringing computer science, engineering, and manufacturing together to solve some of today's biggest problems such as sustainable energy and transport as well as affordable, multi-planetary living in order to avoid future human extinction. Musk describes himself as "an engineer and entrepreneur who builds and operates companies to solve environmental, social and economic challenges."⁶ At one point, Elon Musk led three companies simultaneously that address the issues that are at the core of his identity and vision: Tesla (sustainable transport), SolarCity (decentralized and sustainable energy), and SpaceX (multi-planetary existence).

Musk indeed has a larger than life profile and has been described as "Henry Ford and Robert Oppenheimer in one person,"⁷ as well as "Tony Stark, the eccentric inventor better known as Iron Man."⁸ In fact, Musk made a cameo appearance in the Iron Man 2 movie. In line with his movie avatar, the real-life Elon Musk plans to retire on Mars.

Elon Musk's larger-than-life personality frequently spills over into his Twitter feed. Musk is an avid tweeter and has had some run-ins with the Security and Exchange Commission (SEC) in the past, as some of his tweets led

Telsa, Inc.

to movements in Tesla stock.⁹ The SEC claims that some of his tweets contain material information that has no basis in fact, and thus crossed the line into securities fraud. The issue came to the fore when Musk tweeted in the summer of 2018: “Am considering taking Tesla private at \$420. Funding secured.” The day prior to Musk’s tweet, Tesla’s share price was \$380. The SEC filed securities fraud charges against Musk claiming that his social media statements were false and misleading investors.

In the spring of 2019, Musk settled with the SEC whom Musk called on Twitter the “Short seller Enrichment Committee”—referring to investors that short Tesla’s stock. Short-sellers are investors, who borrow shares, sell them, and then plan to buy them back at a lower price later to profit from the difference. Essentially, short-sellers are betting against a company, and through their short-selling activities put downward pressure on the company’s share price. Elon Musk and Tesla each had to pay a fine of \$20 million to settle with the SEC, without admitting to wrongdoing. Moreover, Musk had to agree that any of his future social media statements needed to be reviewed internally by Tesla prior to posting. Musk also had to step down from the position as chairman of Tesla’s board of directors, but he was allowed to continue to serve as CEO.

Yet, the “taking Tesla private” tweet by Elon Musk in the summer of 2018 marked the beginning of one of the most challenging years in the company’s brief history. After missing production and delivery targets in the first two quarters of 2019, Tesla’s market cap hit a low of \$32 billion, down from \$65 billion a year earlier. And, the company was running low on cash. The short-sellers thought they had won, and Tesla would go bankrupt.

Rather than going bankrupt, however, in early 2020, Tesla, Inc. employed about 50,000 people worldwide and boasted a market capitalization of \$150 billion, an appreciation of more than 6,000 percent over its initial public offering in 2010. As a consequence, Tesla’s shares outperformed the broader market by a large margin. The difference in performance between Tesla and the broader stock market has been more pronounced since the fall of 2019 as Tesla began to exceed performance expectations in subsequent quarters (**Exhibits 3 and 4**).

Brief History of Tesla, Inc.

Tesla, Inc. (TSLA) was founded in 2003 in San Carlos, California with the mission to design and manufacture all-electric automobiles. Indeed, the company was inspired by GM’s EV1 electric vehicle program in California in the late 1990s, which the Detroit automaker shut down in 2003. For a comparison between all-electric vehicles (EVs) and plug-in hybrid electric vehicles, see **Exhibit 5**.

Tesla, Inc. is named after Nikola Tesla, the engineer and physicist who invented the induction motor and alternating-current (AC) power transmission for which he was granted a patent in 1888 by the U.S. Patent and Trademark Office. The Serbian-born inventor was a contemporary of Thomas Edison. Indeed, Edison, the prolific inventor of the light bulb, phonograph, and the moving picture (movies), was at one-point Tesla’s boss. The two geniuses fell out with one another and feuded for the rest of their lives. Edison won the famous “War of Currents” in the 1880s (DC vs. AC) and captured most of the limelight. Because Nikola Tesla’s invention of the alternating-current (AC) electric motor was neglected for much of the 20th century and he did not receive the recognition he deserved in his lifetime, Elon Musk is not just commercializing Tesla’s invention but also honoring Nikola Tesla with the name of his company. Tesla Inc.’s all-electric motors and powertrains build on Tesla’s original inventions.

From day one, Elon Musk was also the controlling investor in the original company, Tesla Motors, Inc., providing \$7 million from his personal funds to get the company started. Tesla confronted a major cash crunch in 2007, which put the future viability of the company into question. Musk stepped up and invested over \$20 million in this round to keep the company afloat, and his dream of transition to sustainable transport alive. In total, Musk

provided \$50 million from his own money to fund Tesla in its early days because finding any outside funding was next to impossible for a new car company during the global financial crisis.¹⁰

Tesla's Secret Strategy (Part 1)

In a blog entry on Tesla's website in 2006, Elon Musk explained the startup's initial master plan:¹¹

1. Build a sports car.
2. Use that money to build an affordable car.
3. Use that money to build an even more affordable car.
4. While doing the above, also provide zero-emission electric power generation options.
5. Don't tell anyone.

To achieve Step 1, Tesla held a design contest for the styling of its first product—Roadster. Lotus Cars, a British manufacturer of sports and racing cars, won the contest. Lotus Cars and Tesla Motors, as it was known then, jointly engineered and manufactured the new vehicle using the Lotus Elise platform. In 2006, *Time* magazine hailed the Tesla Roadster as the best invention of the year in the transportation category. In 2007, Musk was named “Entrepreneur of the Year” by *Inc.* magazine.

In the same year, however, it became clear that the production of the Roadster was not scalable. After taking a closer look at Tesla's financial situation, Musk found that Tesla was losing \$50,000 on each car sold. Tesla's CEO at the time, Martin Eberhard had led investors to believe that the manufacturing of the Roadster cost \$65,000 per car, which appeared to justify the \$92,000 sticker price. Musk found that it cost Tesla \$140,000 just for the parts, subassemblies, and supplies to make each vehicle and that the Roadster could not even be built with Tesla's current tools. He also discovered major safety issues with the existing design. Completely taken aback by the messy state of affairs, Musk commented, “We should have just sent a \$50,000 check to each customer and not bothered making the car.”¹²

In 2007, Elon Musk fired Martin Eberhard unceremoniously and took over the engineering himself. Almost every important system on the initial Roadster, including the body, motor, power electronics, transmission, battery pack, and HVAC, had to be redesigned, retooled or switched to a new supplier. Such dramatic changes were necessary to get the Roadster on the road at something close to the published performance and safety specifications, as well as to cut costs to make it profitable.

By 2008, Tesla Motors was finally able to relaunch an improved version of its Roadster, and thus fulfill the first step of its initial strategy laid out two years earlier. The Roadster is a \$115,000 sports coupé with faster acceleration than a Porsche or a Ferrari. Tesla's first vehicle served as a prototype to demonstrate that electric vehicles can be more than mere golf carts.

After selling some 2,500 Roadsters, Tesla discontinued its production in 2012. The initial Roadster manufacturing process was not scalable (with a maximum production rate of no more than two cars per day) because it was a handcrafted car put together at a former Ford dealership near the Stanford University campus.¹³ Tesla learned that it is better to build an electric vehicle from scratch rather than retrofit a given car platform created for internal combustion engines (ICE). The Roadster 1 had no more than 7 percent of parts in common with the Lotus Elise.

Telsa, Inc.

As a side project, in 2017, Tesla unveiled Roadster 2, a sports coupé that set new records for a vehicle to be driven on public roads: It goes from 0–60 mph in 1.9 seconds and from 0–100 mph in 4.2 seconds, with top speeds of well above 250 mph. The base price of the new Roadster model is \$200,000. First customer deliveries are expected in the second half of 2020.

In Step 2, Tesla focused on its next car: the Model S. This was a car that Tesla designed from scratch with the idea to create the best possible EV that is also scalable for mass production. The Model S is a four-door family sedan, with an initial base price of \$73,500. Depending on the size of the battery pack (up to 100kWh), the range of the vehicle is between 210 and 330 miles. Unveiled in 2009, the Model S appeals to a much larger market than the Roadster, and thus allows for larger production runs to drive down unit costs. When deliveries began in 2012, the Model S received an outstanding market reception. It was awarded the 2013 Motor Trend Car of the Year and also received the highest score of any car ever tested by *Consumer Reports* (99/100). By the end of 2019, it had sold more than 300,000 of the Model S worldwide (**Exhibits 1 and 5**).

In 2012, Tesla unveiled the Model X, a crossover between an SUV and a family van with futuristic falcon-wing doors for convenient access to second- and third-row seating. The Model X has a similar range as the Model S, with between 250–330 miles per charge. Technical difficulties with its innovative doors, however, delayed its launch until the fall of 2015. The initial base price of the Model X was \$80,000, with the signature premium line ranging from \$132,000 to \$144,000, thus limiting its mass-market appeal. By the end of 2019, it had sold more than 150,000 of the Model X worldwide (**Exhibits 1 and 5**).

Tesla also completed Step 3 of its master plan. In 2016, the electric carmaker unveiled its first mass-market vehicle: the Model 3, an all-electric compact luxury sedan, with a starting price of \$35,000 for the entry-level model with a range of 250 miles per charge. Many want-to-be Tesla owners stood in line overnight, eagerly waiting for Tesla stores to open so that they could put down their \$1,000 deposits in order to secure their spots on the waiting list for the Model 3—a car they had never even seen, let alone ever taken for a test drive. As a result of this consumer enthusiasm, Tesla received more than 500,000 preorders before the first delivery, and thus \$500 million in interest-free loans. Despite initial difficulties in scaling-up production, deliveries of the Model 3 began in the fall of 2017. By the end of 2019, Tesla had delivered more than 450,000 of the Model 3 globally.

Step 4 of Musk’s initial master plan for Tesla aims to provide zero-emission electric power generation options. To achieve this goal, Tesla acquired SolarCity, a solar energy company, for \$2.6 billion in 2016. With the acquisition of SolarCity, to which Musk is also chairman and an early investor, Tesla, Inc. is the world’s first fully integrated clean-tech energy company, combining solar power, power storage, and transportation. In the process, Tesla’s mission also changed from “to accelerate the advent of sustainable transportation” to “accelerate the advent of sustainable energy,” thereby capturing the vision of a fully integrated clean-tech energy company.

Step 5: “Don’t tell anyone”—thus the cheeky title of Elon Musk’s original blog post: “Tesla’s Secret Strategy.”

Tesla completed an initial public offering (IPO) on June 29, 2010, the first IPO by an American automaker since Ford in 1956. On the first day of trading, Tesla’s market capitalization stood at \$2.2 billion; less than 10 years later, it stood at \$150 billion. Despite significant future growth expectations reflected in Tesla’s stock price appreciation, the company is still losing a significant amount of money: \$900 million in 2015; \$675 million in 2016; almost \$2 billion in 2017; close to \$1 billion in 2018; and over \$860 million in 2019. Tesla’s revenues in 2019 were \$24.5 billion, up from \$21.5 billion in 2018 and \$11.8 billion in 2017. **Exhibit 2** provides an overview of Tesla’s key financial data, 2015–2019.

Tesla's Secret Strategy (Part 2)

In 2016, 10 years after Tesla's initial "secret strategy," Elon Musk unveiled the second part of his master plan for the company ("Master Plan, Part Deux") to continue the pursuit of its vision "to accelerate the advent of sustainable energy."¹⁴ Again, Tesla's CEO and co-founder Elon Musk detailed a set of stretch goals:

1. Create stunning solar roofs with seamlessly integrated battery storage.
2. Expand the electric vehicle product line to address all major segments.
3. Develop a self-driving capability that is 10 times safer than manual via massive fleet learning.
4. Enable your car to make money for you when you aren't using it.

In the updated strategy, Step 1 leverages the 2016 acquisition of SolarCity. Tesla, Inc. has morphed from a manufacturer of all-electric cars into one of the first fully integrated sustainable energy companies, combining energy generation with energy storage, while providing zero-emission vehicles.

In Step 2, Elon Musk is planning to expand the lineup of Tesla's electric vehicles to address all major segments, including compact SUVs, pickup trucks, and heavy-duty semis.

In 2019, Tesla launched the Model Y, a compact luxury SUV that is a smaller and much lower-priced version of the Model X, starting at \$39,000 (and a 230-mile range). The first customer deliveries for the Model Y are planned for spring 2021. A longer-range (280 miles) and thus a higher-priced version of the Model Y starting at \$60,000 will be available in the fall of 2020. Customer demand for the Model Y is expected to be even stronger than that for the Model 3, the compact luxury sedan.

In late 2019, Elon Musk set out to change the paradigm of what a pickup truck should look like and how it should perform by unveiling the Cybertruck. Musk emphasized that the pickup truck concept had not changed in the past 100 years and that he decided to do something completely different. Musk reminded the audience that he does zero market research whatsoever, but rather he starts with a clean slate by using a first-principles approach to design products (that is, reducing problems to the fundamental parts that are known to be true, and start building from there).

Musk designed a truck of the future the way he thought it should look and perform. The result is a futuristic-looking triangular truck using exoskeleton of ultra-hard stainless steel, which provides more interior room and also higher passenger safety and great vehicle durability. Customer deliveries are planned for late 2021, with the base model of the Cybertruck achieving a range of 250 miles per charge, and starting at \$40,000. The high-end version of the Cybertruck equipped with the performance tri-motor and a range of 500 miles per charge starts at \$70,000 (**Exhibit 7**). Demand for the Cybertruck appears to be high because Tesla received over 250,000 preorders just within a few days of introducing the futuristic vehicle.

Moving into the pickup truck segment of the car industry is a bold move by Tesla because pickup trucks account for roughly one-third of sales of the incumbent carmakers (GM, Ford, and Fiat Chrysler Automobiles) in the United States, but generate some two-thirds of profits. Also, unlike other models, the Cybertruck is unlikely to cannibalize an existing segment in which Tesla has vehicles in its lineup. In contrast, sales of Model S and Model X vehicles fell sharply after the Model 3 was introduced, and are expected to drop further with the Model Y introduction. No such direct cannibalization is expected with the Cybertruck as the customer profile of truck buyers is generally quite different from those buying high-performance luxury sedans or SUV crossovers.

Telsa, Inc.

Overall, Tesla has made significant improvements along a number of important performance dimensions in its vehicle line since customer deliveries for its first mass-produced car, the Model S, began in 2012. **Exhibit 8** details Tesla's product improvements over time by comparing the 2012 Model S with the 2021 Cybertruck.

In Step 3, Tesla is aiming to further develop the self-driving capabilities of its vehicles. The goal is to make self-driving vehicles 10 times safer than manual driving, and thus being able to offer fully autonomous vehicles (**Exhibit 9**).

Fully autonomous driving capabilities are required for Tesla to fulfill Step 4 of the new master plan: Turn your car into an income-generating asset. Musk's goal is to offer an Uber-like service made up of Tesla vehicles, but without any drivers. On average, cars are used less than three hours a day. The idea is that an autonomous-driving Tesla will be part of a shared vehicle fleet when the owner is not using their car. This will drastically reduce the total cost of ownership of a Tesla vehicle, and it will also allow pretty much anyone to ride in a Tesla because of the sharing economy.

Tesla's Manufacturing

When Tesla began selling its first Roadster model in 2008, it was plagued with both thorny technical problems and cost overruns. The fledgling startup managed to overcome these early challenges, in part by forming strategic alliances. Tesla entered alliances with premier partners in their respective category: Daimler in car engineering (2009; discontinued in 2014); Toyota in lean manufacturing (2010; discontinued in 2016); Panasonic in batteries (2014; ongoing).

The alliance with Toyota brought other benefits for Tesla besides learning large-scale, high-quality manufacturing from the pioneer of lean manufacturing in the car industry. It enabled Tesla to buy the former New United Motor Manufacturing Inc. (NUMMI) factory in Fremont, California in 2010. The NUMMI factory was created as a joint venture between Toyota and GM in 1984. Toyota sold the factory to Tesla in the aftermath of GM's Chapter 11 bankruptcy in 2009.

The NUMMI plant was the only remaining large-scale car manufacturing plant in California and is a mere 25 miles from Tesla's Palo Alto headquarters. Tesla manufactures both the Model S and the Model X in its Fremont, California factory. The Model S and Model X share the same vehicle platform and about 30 percent in parts.

Unlike more traditional car manufacturers that outsource components and tend to rely heavily on third-party suppliers, Tesla is largely a vertically integrated company. Tesla put a value chain together that relies on integration from upstream research and development, as well as battery and electric vehicle manufacturing to downstream battery software; hardware chip and software design for full self-driving (FSD) capability and autopilot; and provides a dense network of supercharging stations (complimentary for all Model S and Model X owners), as well as sales and service—all done in-house. Tesla's proprietary supercharging station network allows seamless coast-to-coast travel with any Tesla vehicle.

Gigafactory 1 (Giga Nevada)

Tesla also made several multi-billion-dollar commitments when building super large manufacturing facilities, dubbed "gigafactories." Elon Musk describes a gigafactory as the machine that builds the machine. Tesla Gigafactory 1 (or, Giga Nevada) is a 1,000-acre facility near Reno, Nevada, with an option to expand by an additional 2,000 acres. The new factory required a \$5 billion investment and produces an estimated 50 GWh/year of battery packs

with a full capacity of 150 GWh/year. Giga Nevada's current output can produce 500,000 battery packs per year, with an estimated 1.5 million battery packs upon final completion, in late 2020.

Lithium-ion batteries are the most critical and the most expensive component for electric vehicles, and each car requires a battery pack. Tesla also uses battery packs for its Powerwall (residential use) and Powerpack (commercial use) product offerings, which are rechargeable lithium-ion battery stations that allow for decentralized energy storage and use. The production of batteries in Gigafactory 1 is done in collaboration with Panasonic of Japan, a global leader in battery technology.

Gigafactory 2 (Giga New York)

Giga New York is photovoltaic (PV) factory by Tesla's subsidiary, SolarCity, and located in Buffalo, NY. Gigafactory 2 produces Tesla's Solar Roof, among other solar panel products. Tesla's Solar Roof is a system of interconnected solar cells that mimic the look of more traditional roofing systems. Basically, the entire roof functions like one large solar panel and the energy generated can be stored in the Tesla Powerwall and used for residential consumption.

Gigafactory 3 (Giga Shanghai)

Requiring an investment of \$2 billion, Giga Shanghai is Tesla's first production facility outside the United States. Rather than import vehicles from the United States to its main international markets in China and Europe, Tesla has begun to build factories in the respective overseas markets.

The design idea behind Giga Shanghai is to co-locate a car manufacturing facility and battery pack production. Tesla's new factory in China was completed in record time—it took less than 12 months from breaking ground in January 2019 until locally produced Model 3s were rolling off the production line. Benefiting from China's lifting of restrictions for foreign producers in the auto industry, Tesla is the sole owner and operator of Giga Shanghai, without any local joint-venture partner as previously required. Sole ownership of Gigafactory 3 enables Tesla to protect its proprietary technology and know-how.

The production target for its new Gigafactory is to produce 500,000 Model 3s per year for the Chinese market, rather than import vehicles from the United States. Foreign imports into the Chinese markets of the same model (Model 3) are more expensive due to taxes and tariffs, but also due to higher cost of manufacturing in the United States. Some estimates put the production cost of a Model 3 made in China at \$10,000 (or some 30 percent) lower than producing the same Model 3 built in the United States.¹⁵

Gigafactory 4 (Giga Berlin)

In late 2019, Elon Musk announced building Giga Berlin (Gigafactory 4) in Germany. Giga Berlin places Tesla in the heart of the leading European carmakers, who are located in Germany including the Volkswagen Group (owner of the VW, Audi, Porsche, and several other brands), BMW, and Daimler, the maker of the Mercedes line of cars, among other models. Tesla committed an investment of \$4.5 billion and hopes to have Giga Berlin completed by the end of 2021. Tesla is using the same template as in Giga Shanghai by producing both battery packs and vehicles in the same location. The plan is to produce 150,000 Model Ys annually by that time, and when reaching full capacity of 500,000 units per year.

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In 2020, Elon Musk announced that Tesla plans to have a gigafactory on each continent to produce vehicles and battery packs for the local markets. Musk also stoked speculation of building Gigafactory 5 in the United States, in particular, in Austin, Texas (“Giga Texas”).¹⁶

Tesla’s Business Model

Tesla’s business model differs from traditional car manufacturers along several dimensions, including:

Direct-to-consumer sales via online website (www.tesla.com) and company-owned delivery centers. Tesla does not use car dealers, and therefore, it is running into legal obstacles in some U.S. states. In 2019, Tesla announced that car ordering is online only (to bring Model 3 costs down further), only to later reverse that decision and keep a number of physical show rooms open. The result of this reversal is raising vehicle prices by an estimated 3 percent.¹⁷ However, orders in physical stores are also made on the Tesla website. The EV-startup company facilitates online ordering by providing limited choices in colors, interiors, wheels, and a few other customization options. This makes online ordering simple, but also reduces manufacturing complexity as the number of permutations are somewhat limited, unlike more traditional carmakers.

“No-haggle” policy. Tesla does not discount vehicles. Prices of vehicles are displayed on the website and are non-negotiable. The no-discount policy holds even for Musk family members as the CEO reiterated in a widely circulated company memo after a family member had requested a discount. Musk replied, “Go to Tesla.com, buy the car online, and the price you see there is the family discount.”¹⁸

Low marketing expenses. For the first few years, Tesla’s marketing expenses were zero dollars because Musk believed that all of its resources should be focused on improving the company’s product. Initial Tesla “marketing” was word of mouth. Tesla also does not use any paid celebrity endorsements that are common in the car industry. Yet, the Tesla brand has a cult following not unlike Apple in its early days; indeed, several marketing professionals have created pro-bono Tesla high-end ad campaigns and uploaded them on YouTube to show their enthusiasm for the company’s vision. Indeed, media coverage is high on Tesla. Although no longer zero in 2020, Tesla’s marketing expenses are considered low by industry standards.

Social network. Rather than a simple communications device, Tesla’s website (www.tesla.com) is a social media platform where users can connect with each other and Tesla itself. In addition, the website contains Elon Musk’s blog where the CEO frequently shares company and technology updates, or addresses concerns. Also, Elon Musk’s Twitter account has over 31 million followers.

Software platform. All Tesla cars are linked through a 4G Wi-Fi connection, with the base program provided complimentary. The Tesla fleet is akin to a network of autonomous vehicles. This allows Tesla’s car software, such as the autopilot, to learn from other vehicles’ experiences, as well as consider real-time road and weather conditions. Moreover, by early 2020, Tesla remains the only car manufacturer globally that provides over-the-air (OTA) software updates for its owners; and thereby incrementally upgrading the vehicles through continued new software releases. Software tweaks may cover fundamental issues such as improving the autopilot or more mundane things such as viewing YouTube videos in HD while waiting at a supercharger.

Vehicle service model. While OTA software updates have upended much of the traditional service model done by car dealers, Tesla is also changing other aspects of the vehicle service model. Given the large number of vehicles on the road (the average car in the United States is 11 years old, and many cars are driven for 20 years), the legacy carmakers make a tidy profit by selling spare parts to car dealers, body shops, and other car repair facilities to keep

their large fleet of vehicles operating. Tesla has produced less than 800,000 vehicles in total; more importantly, EVs need a lot less service than traditional ICE cars.

Open-source innovation. Tesla shares its patents with any interested party to help set a new standard in the car industry. Elon Musk's goal is to accelerate the transition to sustainable transport through electrification of vehicles. Moreover, he believes that an open-source mindset at Tesla will encourage continued innovation and helps in attracting the best engineering talent globally. The Tesla CEO believes that patents tend to hinder innovation rather than help to spur it. In a 2014 blog post, Musk wrote:

Tesla Motors was created to accelerate the advent of sustainable transport. If we clear a path to the creation of compelling electric vehicles, but then lay intellectual property landmines behind us to inhibit others, we are acting in a manner contrary to that goal. Tesla will not initiate patent lawsuits against anyone who, in good faith, wants to use our technology. ... Our true competition is not the small trickle of non-Tesla electric cars being produced, but rather the enormous flood of gasoline cars pouring out of the world's factories every day. ... We believe that Tesla, other companies making electric cars, and the world would all benefit from a common, rapidly-evolving technology platform.¹⁹

Tesla's Diversification

Besides expanding its electric vehicle product line to all major segments (Step 2, Master Plan 2), including a pickup truck, a commercial semi-truck, and a new roadster, Tesla is diversified into other business activities.

Tesla Energy. Tesla is leveraging its technological expertise in batteries, thermal management, and power electronics that were originally developed for its EVs in energy storage. Combining these various technologies allows Tesla Energy to offer decentralized energy generation (through Solar Roof), energy storage (Powerwall and Powerpack), and energy use. Revenues of Tesla Energy were \$1.6 billion in 2018, up from \$181 million in 2016.

Tesla provides energy generation via its innovative Solar Roof that looks like regular shingles but cost less, all things considered, and last longer. For residential consumers, Tesla offers its Powerwall that allows customers to store the solar energy captured on their roofs for later use. Energy generation, therefore, becomes decentralized. This implies that consumers can generate and use energy without being dependent on any utility and can sell back excess energy to utilities. The idea is that consumers will generate not only energy for the use of their Tesla cars but also enough to cover the energy needs of their entire house. Tesla Energy is offering a similar solution on a larger scale for commercial use. Decentralized energy generation and storage (Powerpack) is of interest to commercial customers in order to avoid power outages and to use renewable energy.

Tesla Artificial Intelligence. Tesla has considerable expertise in artificial intelligence (AI), derived not only from its large drove of data but also from its acquisition in 2019 of DeepScale, a machine learning startup with a focus on computer vision. To provide autonomous-driving capabilities of its vehicles (Level 5 in **Exhibit 9**), Tesla integrates hardware and software. In particular, it developed its own AI-chip that affords full self-driving (FSD) capabilities ("autonomy").

Elon Musk credits autonomy and electrification as the two technological discontinuities that allowed Tesla to enter the car industry, and to scale-up to mass production.²⁰ Tesla's fleet of EVs is a network of interconnected autonomous vehicles that have accrued 18 billion miles of real-world driving. Tesla applies machine learning algorithms (i.e., artificial neural networks) to these data to constantly improve and upgrade its autopilot ("massive fleet learning"; Step 3, Master Plan 2). Alphabet's Waymo, Tesla's closest competitor in autonomous driving has accrued a total of 20 million miles in real-world driving.

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Tesla Insurance. Leveraging vast amounts of fine-grained data, the EV company now offers Tesla Insurance, which offers micro-targeted pricing for car insurance to Tesla owners. Lower insurance premiums correlate with more use of the autonomous-driving mode, a safer way of driving (Step 3, Master Plan 2). Given that all vehicles are connected, Tesla has a log of each driver's trips, including how many miles driven, and when and where. Tesla also knows whether the driver obeys the speed limit and other rules of the road. Given that Tesla has complete transparency on how the vehicle is being used, it can fine-tune the respective car insurance premium to a much greater degree than traditional car insurers.

Tesla and the Competition

Tesla's competition can be grouped around three categories:

1. the new-vehicle market overall, that is, EVs and ICE cars combined;
2. EV segment only; and
3. geography.

In the overall market for new cars, including both traditional ICE cars and EVs, the market share for electric vehicles remains small, with 2 percent in the United States, 1.5 percent in Europe, and 5 percent in China. In the EV-only segment, however, Tesla is a leader with an 18 percent market share globally (in 2019). Indeed, Tesla's Model 3 was the most-sold EV worldwide (in 2018), and the more expensive Model S and Model X coming in at fourth and fifth, respectively (**Exhibit 10**). At the same time, demand for the Nissan Leaf (EV) and the Toyota Prius (PHEV), both popular in the early 2010s, has declined. In terms of geography, the United States, China, and Europe are Tesla's most important markets.

United States

Exhibit 11 shows annual new vehicle sales (ICE cars and EVs combined) in the United States over time. In the past five years, Americans purchased some 17 million new vehicles per year. The average sales prices of new vehicles have increased to \$36,700, driven in large part by strong demand for SUVs and pickup trucks. At the same time, gas prices in the United States have remained low, hovering around \$2.50 a gallon (**Exhibit 12**).

Over the past decade, the legacy carmakers in the United States (GM, Ford, Fiat Chrysler) have dedicated on average no more than 10 percent of their total R&D spending on electrification and autonomy. Much of the profits in the industry were derived from strong demand in SUVs and pickup trucks (with traditional ICEs).

Although Tesla's market share in the total new-vehicle market remains small, it is the leader in EV car sales in the United States. Tesla's Model 3 alone, a luxury compact sedan, holds some 60 percent market share in the EV segment. There are some questions whether the demand for Tesla Model 3 will remain strong because Tesla no longer qualifies for any federal credits. When first enacted, the federal tax credit for the purchase of new electric and plug-in hybrid electric vehicles of \$7,500 was to phase out gradually once a car manufacturer sold more than 250,000 EVs and PHEVs (**Exhibit 5**). In 2009, the limit per car manufacturer was reduced to 200,000. Both, Tesla as well as GM have crossed that threshold.

General Motors Co. (GM) is the largest of the legacy carmakers (in terms of the number of cars sold) in the United States, with some 17 percent market share and revenues of \$138 billion in 2019. GM's market cap stood at some \$50 billion (in early 2020). In 2019, GM sold 7.7 million vehicles globally, with 2.9 million vehicles in the

United States. GM vehicle sales are declining in the United States after weaker demand for some pickup trucks and SUVs. GM's net income was \$6.7 billion in 2019.

GM's efforts in the electrification of vehicles have been met with mixed results. In the 1990s, GM was a leader in electric car technology with its innovative EV1. To respond to environmental regulation in California, GM launched the fully electric car in 1996 with a range of up to 105 miles per charge. The EV1 was the first electric vehicle designed and produced by a mass car manufacturer making about 1,100 EV1. When California's zero-emission mandate was revoked, GM recalled and destroyed its EV1 cars and terminated its electric-vehicle program in 2002. Ever since GM has been lagging in electrification. The Detroit automaker did not have a suitable car in its lineup to compete against the popular Toyota Prius (PHEV) or the Nissan Leaf (EV). The launch of the Chevy Volt (PHEV) was delayed by over a decade because GM had to start its electric-vehicle program basically from scratch. In 2017, GM introduced the Chevy Bolt, an all-electric vehicle with a 230-mile range on a single charge and starting price of \$37,500. Yet, the Chevy Volt is not selling well, with 16,500 units sold in 2019, down 9 percent from 18,000 in 2018 and down 30 percent from 21,500 sold in 2017.

GM CEO Mary Barra believes that electrification autonomy are of great importance to GM's future. In 2020, GM committed \$20 billion to develop electric and autonomous vehicles, planning to have at least 20 EVs in its lineup by 2023. GM also announced (in 2020) to have achieved a breakthrough in battery technology, which allows EVs to travel over 400 miles on a single charge.²¹

To make progress in autonomy, in 2016, GM acquired Cruise, a startup focused on self-driving car technology, for \$1 billion. In the same year, moreover, GM invested \$500 million to form an equity alliance with Lyft, the second-largest ride-hailing company in the United States after Uber. GM wants to be in the mobile transportation and logistics space because the age-old private car ownership model is likely to shift in favor of fleet ownership and management. Consumers will rent a car for a specific ride, rather than own a car as a fixed asset. Private cars in the United States are used no more than 5-10 percent of the time, and sit idle for most of the day. Car owners have the fixed costs of purchasing a car, buying insurance, and maintaining the car. Lyft, in turn, has an alliance with Waymo (a subsidiary of Alphabet, the parent company of Google), one of the leaders in an autonomous car technology venture.

Ford Motor Co. (F) is the second-largest incumbent carmaker in the United States, with some 14 percent market share and revenues of \$155 billion (2019). Ford's market cap stood at some \$30 billion (in early 2020). In 2019, Ford sold close to 5 million vehicles globally, with 2.4 million vehicles in the United States. Ford's vehicle sales, however, are declining in the United States in the SUV segment, which more than offset gains in the market for pickup trucks. In 2018, Ford announced that it will stop making most of the sedans in its lineup in order to focus on pickup trucks and SUVs, and thus basically exiting a market segment that is created with its iconic Model T first sold in 1908.

Ford derives two-thirds of its sales from the U.S. market and a bit over 20 percent from Europe. In recent years, Ford lost money in all of its non-U.S. operations; only North America was profitable consistently because of its popular F-series pickup trucks. Both GM and Ford are faced with weakening demand for their vehicles and rising labor costs in the United States.

Since 2016, Ford has invested some \$12 billion into electrification. In 2019, the Detroit automaker made a high profile move into electrification by introducing the Ford Mustang Mach-E, with customer deliveries commencing in 2020. Depending on the size of the battery pack, the Mach-E has a range of 240 to 300 miles per charge. Given that the torque of an electric motor is available instantaneous, the Mustang Mach-E is expected to accelerate much more quickly than the Porsche Macan, one of the most popular compact luxury SUVs. The Mach-E will thus com-

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pete head-on with the Tesla Model Y, which has somewhat favorable specs in terms of range, performance, and price.

When launching its new compact luxury sedan, Elon Musk had initially planned to use the name Model E for what is now known as the Model 3. With the Models S and X already on the market and the Models E and Y next in line, Musk got a kick out of the notion that Tesla lineup of the first four vehicles would read S-E-X-Y. Ford thwarted Tesla's plans, however, because it had trademarked Model E for vehicles in 2001, and refused to sell it to Tesla. Now, Ford was using its iconic Mustang brand, as well as its trademarked Model E for its new EV: the Mustang Mach-E, signaling the importance of this all-electric vehicle to Ford's future. Given the small number of EV vehicles sold by Ford, buyers of the Mustang Mach-E will be able to claim a \$7,500 tax credit; thus effectively lowering the starting price of \$44,000.

In the field of autonomy, Ford acquired a majority stake in Argo AI, an artificial intelligence startup. To further the development of its autonomous-driving technology, Ford plans to invest \$1 billion into Argo AI over the next five years.

Rivian Automotive, Inc. In 2019, Ford invested \$500 million into the EV-startup Rivian. Other investors in Rivian include Amazon.com, which invested \$700 million, also in 2019. The Michigan-based EV company is best known for its R1T pickup truck and R1S SUV. Rivian's niche focus is on "adventure vehicles" that will provide off-road capabilities and an overall ruggedness lacking in today's commercial vehicles, combined with a 400-mile range per battery charge. The EV startup was founded in 2009 by RJ Scaringe, who graduated from the Massachusetts Institute of Technology with a doctorate in mechanical engineering.

It is not clear, however, whether Rivian will morph into a stand-alone car designer and mass-manufacturer of electric vehicles such as Tesla or whether it will become more of an EV platform company because of its proprietary "skateboard platform" design, which features a large battery under the floor of a chassis upon which original equipment manufacturer (OEM) car brands can build different models. These vehicles would be zero-emission and fully electric because they are powered by a drivetrain and four electric motors, one for each wheel, all developed by Rivian. The R1T pickup truck and R1S SUV might serve as prototypes for such an EV platform strategy. Rivian's CEO RJ Scaringe also indicated that the company would license its technology to other companies. Rivian did also announce, however, that it starts planning to sell its all-electric pickup truck by late 2020, and is accepting customer deposits on its website (<https://rivian.com>). It also purchased a former Mitsubishi Motors plant in Illinois, which has the capacity to produce 250,000 vehicles a year.

Fiat Chrysler Automobiles (FCA). With GM and Ford, Fiat Chrysler makes up the Big Three American car manufacturers. FCA has a 12 percent market share and \$122 billion in revenues (2019). Close to 70 percent of FCA's revenues are in North America, mostly from its iconic Jeep line of vehicles and the Ram pickup trucks. In 2019, Fiat Chrysler sold some 4.4 million vehicles globally, with 2 million vehicles in the United States. FCA's market cap stood at some \$26 billion (in early 2020).

In December 2019, FCA announced that it intends to merge with European PSA Group, maker of the Peugeot brand of cars. The newly combined company would be the third-largest car company globally, just behind the Volkswagen Group and Toyota, but ahead of Nissan-Renault. As an integrated company, FCA and Peugeot would be selling close to 9 million cars and with revenues of some \$190 billion.

In early 2020, FCA also announced a joint venture to develop electric vehicles with Foxconn, an electronics OEM, best known for its assembly of Apple iPhones in China. In 2016, Foxconn bought Sharp, a Japanese electronics company, in order to offer its products under the Sharp brand. FCA is not only a latecomer to vehicle

electrification and autonomy, but continues to invest less in these two new technological discontinuities than other legacy carmakers.

China

In terms of units, China, with some 26 million new vehicles sold in 2019, is by far the largest car market globally. In 2019, however, new vehicle sales in China were down by 8.2 percent from 28 million cars sold in 2018. Moreover, the Chinese car market is highly competitive with a large number of smaller car manufacturers offering low-priced basic vehicles combined with super-demanding customers. Also notable is that while luxury SUVs and sedans such as Porsche, Audi, or BMW are priced similarly as in the United States, some 25 percent of the Chinese new car market consists of local brands that sell new, low-end cars for less than \$12,000 (a market segment that does not exist in the United States or Europe).²²

The Chinese authorities consider EV manufacturing a strategically important industry that will help to achieve the China 2025 industrial plan, providing a road map for global leadership in a number of important high-tech sectors. Some estimates are that China spent more than \$60 billion to jump-start domestic EV production, including research-and-development funding, financing for battery-charging infrastructure, and tax exemptions. China is the largest EV market globally. In 2019, 1.3 million EVs were sold in China, in comparison to 330,000 EVs sold in the United States (**Exhibit 13**). The Chinese market is almost four times the size of the EV market in the United States, albeit the average price point for new vehicles is generally lower.

There are a large number of EV manufacturers in China. Most of them focus on the low end of the market, in particular, to help consumers take advantage of EV-quotas and other tax incentives that the Chinese authorities put in place to foster domestic production of all-electric vehicles and to reduce air pollution. Most domestic EV producers are unlikely to survive without government support and other incentives. Given that some of the tax incentives granted for the purchase of all-electric vehicles have been reduced by the Chinese authorities recently, demand for EVs in China has fallen by 4 percent in 2019. Previously, the year-over-year growth rate for new EV sales in China ranged from 50 percent to 367 percent from 2013 to 2018 (**Exhibit 14**).

The Chinese market provides significant growth opportunities for Tesla. In the luxury EV segment, in particular, Tesla's main Chinese competitor is NIO, which delivered 20,000 EVs in 2019. Unlike Tesla, NIO outsources procurement of battery packs and focuses mainly on design and marketing. NIO EVs have an appealing design, and the company provides an upscale customer experience ("NIO houses"). NIO is also active in Formula-E racing. However, some EV-industry experts consider NIO to be some five years behind Tesla in technology development, however.²⁴

One challenge that Tesla and other EV makers face in China (and Europe) is the fact that in the United States, most Tesla owners tend to charge their vehicles at home in their own garages. Given the long-range of Tesla vehicles, commuters in the United States begin each day with a full charge, negating the need to charge at work. In contrast, in China (and Europe) most people live in apartment complexes in more densely populated areas, often with no private parking options. This makes the need for a dense public charging station network much more pressing and can limit the EV adoption rate in China (and Europe). Tesla is building its own proprietary supercharging network globally.

In terms of U.S. competitors, only GM plays a role in the overall Chinese car market. Prior to its bankruptcy filing in 2009, GM was mainly focused on the U.S. domestic market. Now, close to 60 percent of GM's revenues come from outside the United States. The Chinese market is becoming increasingly important to GM's performance, already accounting for greater than 40 percent of total revenues. This number has risen steadily in the past

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few years. Unlike some of the other U.S. carmakers, GM entered the Chinese market earlier. In 1997, GM formed a joint venture with Shanghai Automotive Industrial Corp. (SAIC), one of the “big four” Chinese carmakers and one of the largest companies worldwide. In 2018, GM sold more cars in China than it did in the United States. GM’s market share is 14 percent. GM’s China operation has been cost-competitive from their entry into the market.

In contrast, Ford’s current presence in China is negligible, with less than 2 percent market share in 2019, down from 5 percent in 2016. FCA’s position in China is even weaker with less 1.8 percent market share in 2019. The hope is that FCA’s joint venture with the electronics company Foxconn will allow FCA to penetrate the Chinese market more in the future.

Europe

Around 15 million new cars are sold a year in Europe. The European car market is one of the most fragmented in highly developed economies, with a number of smaller local competitors such as Alfa Romeo, Fiat, Peugeot, Renault or Opel, while at the same it is also home to some of the world’s best-known car brands such as Porsche, Audi, and VW (all part of the Volkswagen Group), Daimler, and BMW. Following losses over many years, GM has exited the European car market altogether. It stopped production of cars in Russia in 2015, and sold its European subsidiaries, Opel and Vauxhall, in 2017. As of 2020, Europe also has the smallest percentage of EV vehicles on the road (1.5 percent) among the big three car markets (Europe, China and the United States), in part, due to the lack of public charging options and perceptions that ICE cars are superior.

The Volkswagen Group is the world’s largest car manufacturer by volume (over 10 million vehicles in 2019). Following the diesel emissions scandal (“Dieselgate”) in which VW engineers installed so-called defeat devices in all its smaller (2.0 liter) TDI engines beginning with the model year 2009, the Volkswagen Group was in a crisis. These defeat devices were software codes contained in the car’s onboard computer. The computer was programmed to detect when the car was being tested for emissions by assessing a host of variables, including whether the car was moving or stationary, whether the steering wheel was being touched, what the speed and duration of the engine run were, and so forth. This sophisticated defeat device allowed the vehicles to pass the required and rigid U.S. emissions tests. In reality, however, the vehicles equipped with TDI engines actually exceeded the limits for pollutants by up to 40 times during use. Between 2009 and 2015, VW sold 500,000 TDI vehicles equipped with defeat devices in the United States and a total of 11 million worldwide. Dieselgate cost VW \$25 billion in fines and legal settlements, not to mention the loss of reputation.

With a new top management team and Dieselgate as a catalyst for a strategic transformation, the Volkswagen Group not only streamlined its production to become more cost-competitive but perhaps, more importantly, it led to a strong commitment to electrification and autonomy. VW is dedicating \$30 billion by 2023 to produce fully connected EVs, as well as building out a network of public charging stations.²⁵ The Volkswagen Group announced a commitment to producing some 20 million EVs by 2025 or some 20 percent of its current total production. By 2030, VW plans for its lineup of vehicles to be 40 percent fully electric. Some of the first full-electric vehicles available are the Audi e-tron (2018) and the Porsche Taycan (2019). The VW Group plans to launch some 70 new EV models by 2028. The conglomerate targets to be fully CO₂-neutral by 2050.

Abstracting from VW’s luxury brands such as Porsche and Audi, the vast number of vehicles in VW’s lineup is more complementary to Tesla’s higher-end vehicles such as the high-volume, lower-priced Volkswagen brand. And with Giga Berlin, Tesla made a significant strategic commitment to Germany and Europe, allowing it to plan for a capacity of 500,000 locally-produced vehicles, mostly Models S and Y.

VW's strong strategic commitment to electrification and autonomy could be a tipping point for their widespread adoption in Europe. Uncertainties remain concerning consumer reception as well as government regulations in Germany and across the European Union. Globally, carmakers have committed a combined \$225 billion to electrification and autonomy by 2023, with the largest number of new EVs expected in China and Europe.²⁶

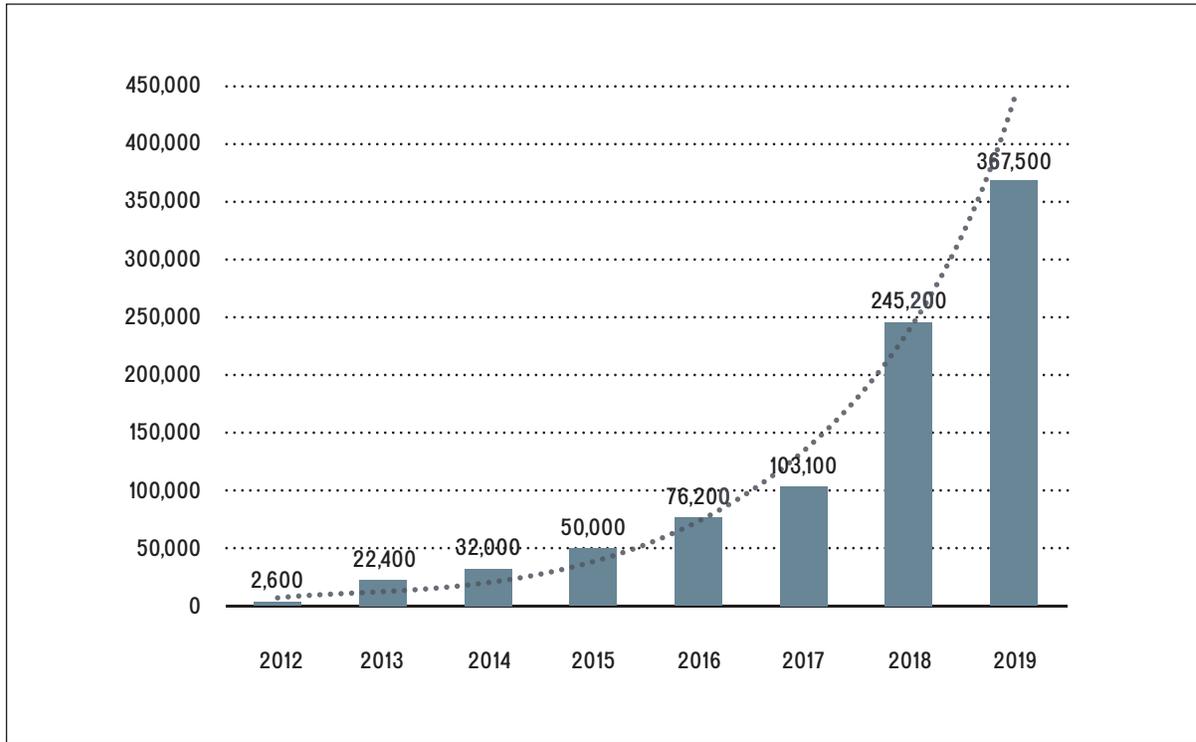
Coming Home

As the Gulfstream G700 was touching down in Palo Alto's private airport, Elon Musk woke up from his slumber and wondered how he would scale-up production profitably given that the company had several new vehicles in development and was planning to build new gigafactories across the globe. It was clear to him that demand would need to remain strong in Tesla's three key markets: the United States, China, and Europe.

While scaling-up production of Model 3 was "hell," he just had promised 500,000 vehicles to be produced in 2020. Scaling-up customer service and avoiding long wait times for repairs after a fender bender, for instance, appeared to be even more difficult. Musk also was impatient in bringing about the transition to all-electric vehicles to replace internal combustion engines, and thus to promote sustainable mobility . . . in the meantime, his phone kept buzzing, and he began to read more about the new coronavirus and the resulting production slow-down in Giga Shanghai, the place he had just left so ebullient a mere 12 hours earlier . . .

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EXHIBIT 1 Tesla Total Vehicle Deliveries, 2012-2019*



* dotted trendline.

Source: Depiction of publicly available data.

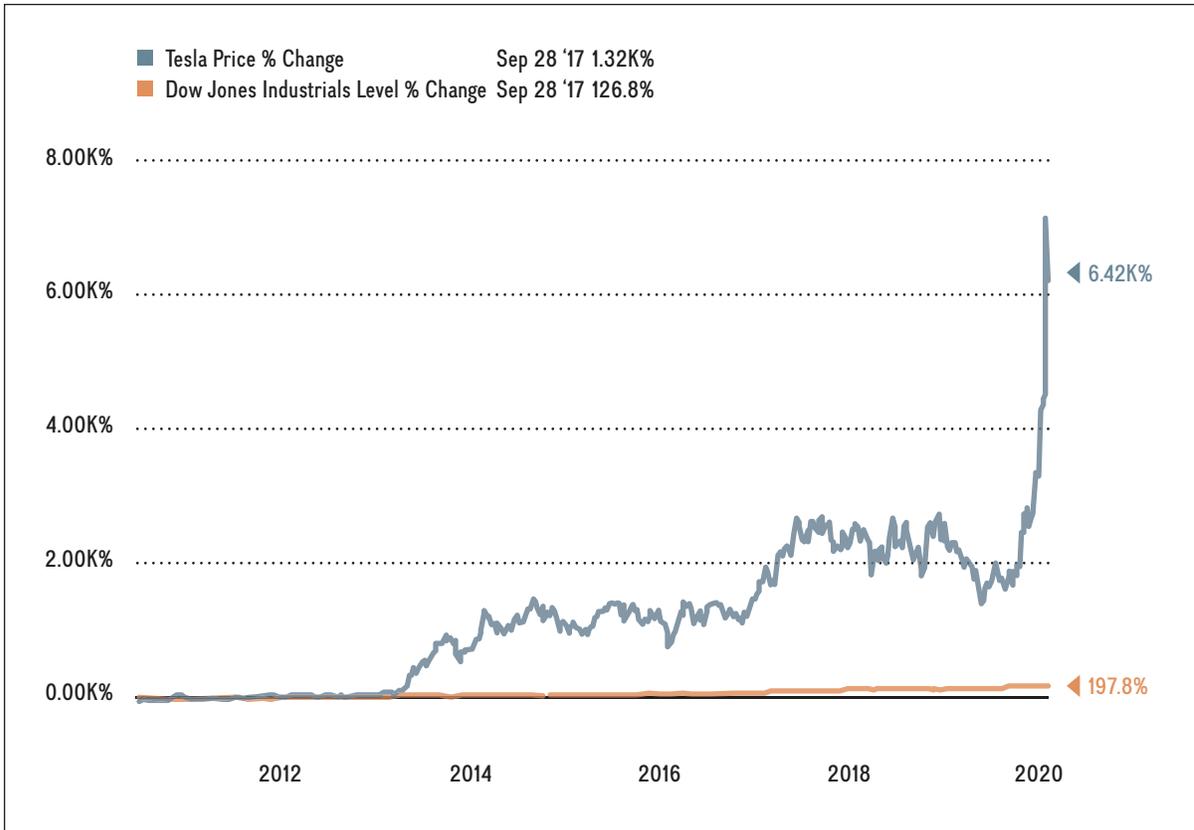
EXHIBIT 2 Tesla Financial Data, 2015–2019 (\$ millions, except EPS data)

Fiscal Year	2015	2016	2017	2018	2019
Cash and short-term investments	1,219.54	3,498.74	3,523.24	3,878.17	6,514.00
Receivables—total	168.96	499.14	515.38	949.02	1,324.00
Inventories—total	1,277.84	2,067.45	2,263.54	3,113.45	3,552.00
Property, plant, and equipment—total (net)	5,194.74	15,036.92	20,491.62	19,691.23	20,199.00
Depreciation, depletion, and amortization (accumulated)	422.59	947.10	1,636.00	1,887.79	2,154.00
Assets—total	8,067.94	33,664.08	8,067.94	33,664.08	34,309.00
Accounts payable	916.15	1,860.34	2,390.25	3,404.45	3,771.00
Long-term debt	2,040.38	6,053.86	9,486.25	9,454.06	11,634.00
Liabilities—total	6,961.47	17,117.21	23,420.71	23,981.97	26,842.00
Stockholders' equity—total	1,083.70	4,752.91	4,237.24	4,923.24	6,618.00
Sales (net)	4,046.03	7,000.13	11,758.75	21,461.27	24,578.00
Cost of goods sold	3,122.52	5,400.88	9,536.26	17,419.25	18,355.00
Selling, general, and administrative expense	922.23	1,432.19	2,476.50	2,834.49	2,646.00
Income taxes	13.04	26.70	31.54	57.84	110.00
Income before extraordinary items	-888.66	-674.91	-1,961.40	-976.09	-862.00
Net income (loss)	-888.66	-674.91	-1,961.40	-976.09	-862.00
Earnings per share (basic) excluding extraordinary items	-6.93	-4.68	-11.83	-5.72	-4.92
Earnings per share (diluted) excluding extraordinary items	-6.93	-4.68	-11.83	-5.72	-4.92

Source: Tabulation of publicly available data.

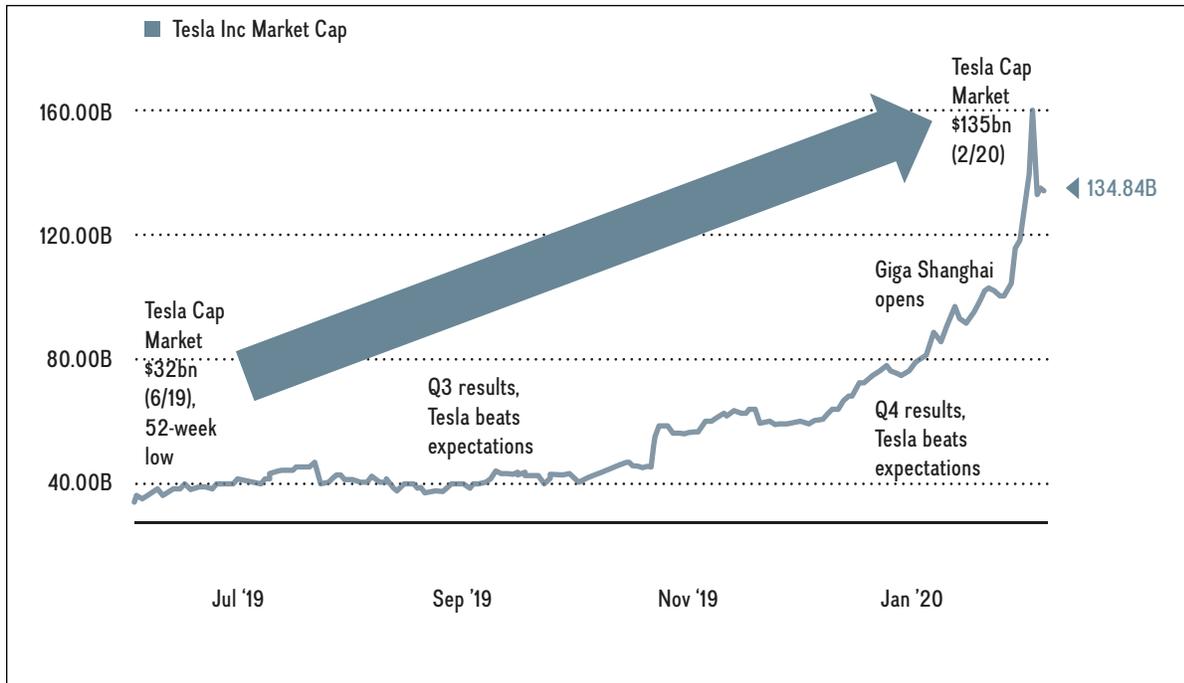
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EXHIBIT 3 Tesla's (Normalized) Stock Performance since Initial Public Offering vs. Dow Jones Industrial Average (DJIA), June 29, 2010–February 14, 2020



Source: Depiction of publicly available data.

EXHIBIT 4 Tesla's Market Capitalization and Key Events, June 2019 - February 2020



Source: Depiction of publicly available data.

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EXHIBIT 5 All-Electric Vehicles vs. Plug-in Hybrids

Electric Vehicles (EVs). All-electric vehicles use batteries as the sole power source to supply the electric energy needed for propulsion. Leveraging the fact that electric motors can also act as generators, electric vehicles utilize regenerative braking to save a significant portion of the energy expended during acceleration, thus increasing the energy efficiency of the vehicle. Pure electric vehicles have a higher torque over a larger range of speeds during acceleration compared with internal combustion engines (ICE). Running and servicing costs of EVs are significantly lower than its gasoline-based counterparts, because electric motors and powertrains have relatively few moving pieces, compared with the hundreds of precision-engineered parts necessary for an internal combustion engine. All-electric vehicles are also quiet and zero-emission.

The battery in all-electric vehicles remains the most expensive part of the car and is subject to deterioration over its lifetime. All-electric vehicles tend to be heavy, and thus wear out tires much more quickly. Given a limited energy-to-weight ratio, the driving range of electric vehicles remains somewhat limited, although has been improving over time. The cost of lithium-ion battery packs (which Tesla is using) is expected to come down over time due to economies of scale and an estimated 18% learning curve. This implies that each time the output doubles, per unit cost (\$/kWh) falls by 18% percent.

Moreover, EVs need to rely on a network of charging stations to overcome range anxiety by consumers; many mass-market electric vehicles cannot drive as far on one charge as gasoline-powered cars can with a full tank of gas. Gas stations can be found pretty much on any corner in cities and every couple of miles on highways. As of 2019, most EVs such as the entry-level Tesla Model 3 or the Nissan Leaf have a range of 200 miles or less per charge; about one half of the range of an average ICE car.

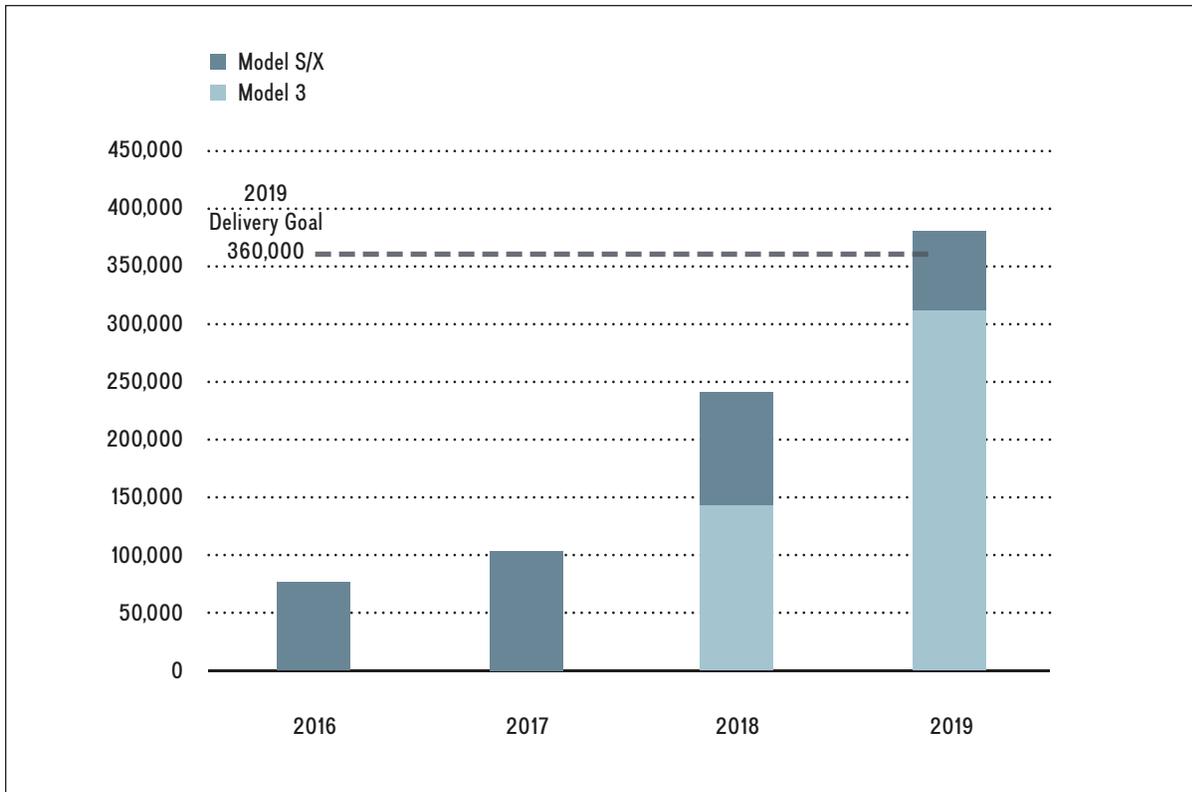
Plug-in Hybrid Electric Vehicles (PHEV). Plug-in hybrid electric vehicles rely on hybrid propulsion, which combines an electric motor with an internal combustion engine. PHEVs attempt to combine the advantages of pure electric vehicles but to avoid the range-restriction problem by using an additional gasoline-powered internal combustion engine. PHEVs contain a battery that stores electricity for the electric motor and can be recharged. Because the battery shares the propulsion load, hybrid engines are significantly smaller than their traditional gasoline counterparts, reducing vehicle weight. The most popular PHEV globally is the Toyota Prius with Toyota over 10 million cars sold since first introduced in 1997.

Tesla's CEO Elon Musk is a strong opponent of hybrid vehicles because he believes that PHEVs combine the disadvantages of both electric and gasoline-powered vehicles, more than offsetting the advantages that each type offers.* Musk argues that hybrids are "bad electric cars" because they must carry around an additional engine and drive train, adding weight, cost, and additional parts to maintain and repair. As such, the Prius in EV-mode only has a range of no more than 25 miles. Musk also criticizes the combustion engines as too small, anemic, and inherently less efficient than full-size engines. Moreover, the combination of these technologies in a single-vehicle adds to the technological complexity, which increases cost, error rates, and maintenance.

*Malone, M. (2009), "Uber Entrepreneur: An Evening with Elon Musk," April 8 <http://bit.ly/2uv2HTI>.

Source: Courtesy of F.T. Rothaermel.

EXHIBIT 6 Tesla Total Vehicle Deliveries by Model, 2016-2019



Source: Depiction of publicly available data.

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EXHIBIT 7 Tesla Cybertruck Models (2021)

Cybertruck Models	Range (mi)	0-60 (s)	Top Speed (mph)	Payload (lbs)	Tow Rating (lbs)	Price
Single Motor RWD	250+	6.5	110	3,500	7,500	\$39,900
Dual Motor AWD	300+	4.5	120	3,500	10,000	\$49,900
Tri Motor AWD	500+	2.9	130	3,500	14,000	\$69,900

Source: Depiction of publicly available data.

EXHIBIT 8 Tesla Product Improvements over Time: Comparing 2012 Model S with 2021 Cybertruck

Cybertruck Models	2021 Cybertruck Tri Motor	2012 Model S Performance	2021 Cybertruck vs 2012 Model S
Price	\$69,900	\$92,400	24% cheaper
Acceleration (0-60 mph)	< 2.9 second	4.4 second	34% faster acceleration
Acceleration (quarter mile)	10.8 seconds	12.6 seconds	14% faster quarter mile
Total Range	500+ miles	265 miles	89% more range
Range-Adjusted Cost	7.1 miles/\$1k	2.9 miles/\$1k	150% more range per dollar
Supercharging Capacity	250 kW+	120kW	108% higher charging rate
Storage	100 ft ³	26ft ³	280% more storage
Seats (adults)	6	5	+1 Seat
Powertrain	All-wheel drive	Rear-wheel drive	+AWD
Automation	Full Self-Driving Hardware	No Autopilot/FSD Hardware	+FSD

Source: Depiction of publicly available data.

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EXHIBIT 9 The Six Stages of Automation (Autonomous Vehicles)

Level 0: No Automation. A human control all the critical driving functions.

Level 1: Driver Assistance. The vehicle can perform some driving functions, often with a single feature such as cruise control. The driver maintains control of the vehicle.

Level 2: Partial Automation. The car can perform one or more driving tasks at the same time, including steering and accelerating, but still requires the driver to remain alert and in control.

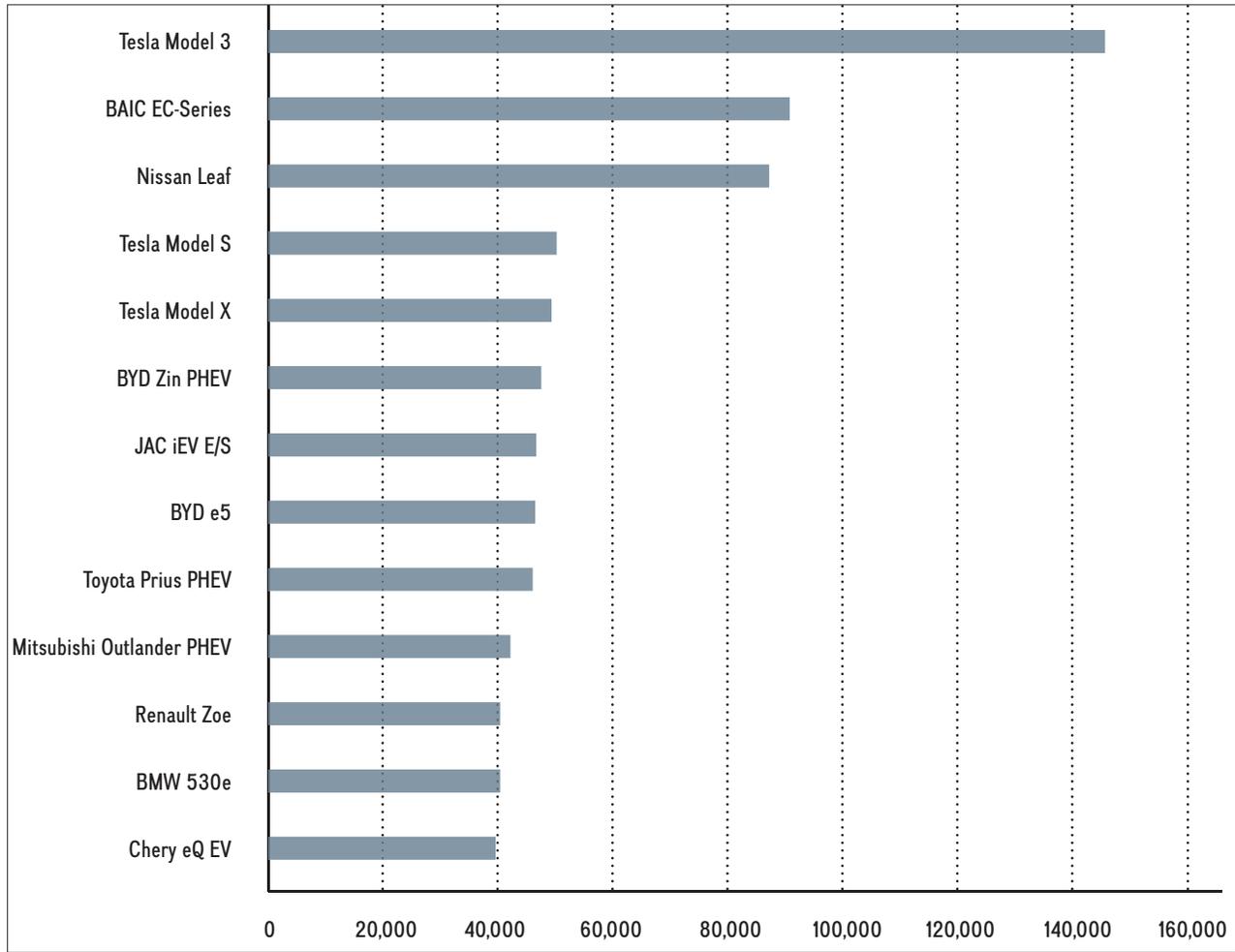
Level 3: Conditional Automation. The car drives itself under certain conditions but requires the human to intervene upon request with sufficient time to respond. The driver isn't expected to constantly remain alert.

Level 4: High Automation. The car performs all critical driving tasks and monitors roadway conditions the entire trip and does not require the human to intervene. Self-driving is limited to certain driving locations and environments.

Level 5: Full Automation. The car drives itself from departure to destination. The human is not needed; indeed, human intervention would introduce more errors than fully automated driving. The car is as good or better than a human and steering wheels and pedals are potentially no longer needed in a vehicle.

Source: Adapted from definitions provided by U.S. National Highway Traffic Safety Administration.

EXHIBIT 10 Electric Vehicle Sales Globally by Model (2018)*

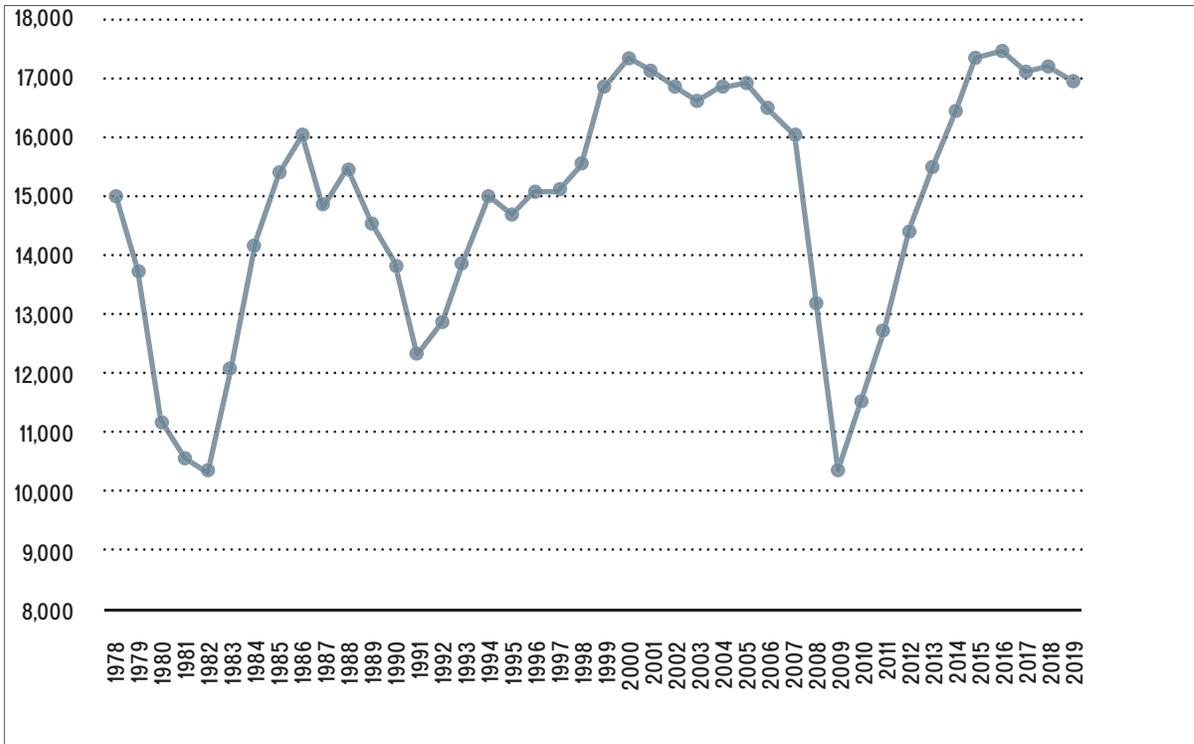


* includes Electric Vehicles (EVs) and Plug-in Hybrid Electric Vehicles (PHEV)

Source: Depiction of publicly available data.

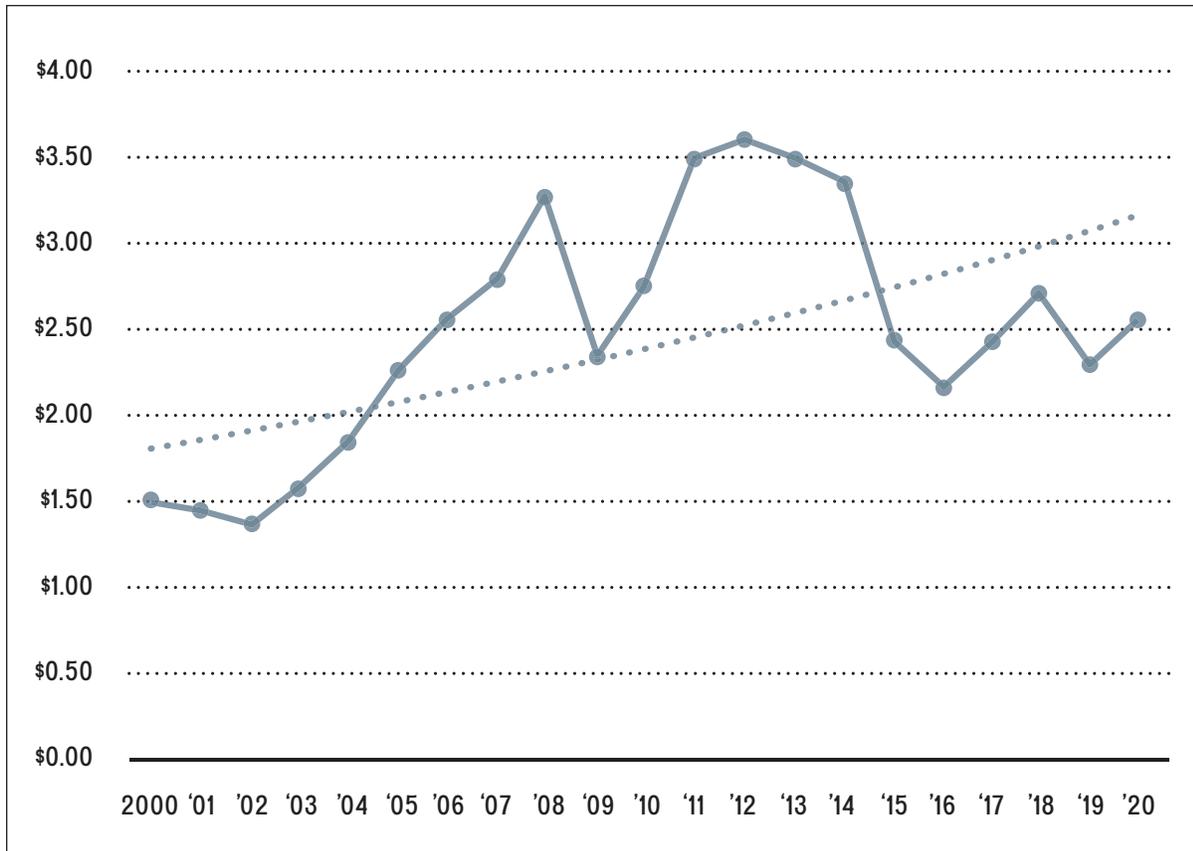
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EXHIBIT 11 Vehicle Sales in the United States, 1978–2019 (in 1,000 units per year)



Source: Depiction of publicly available data.

EXHIBIT 12 Average Annual Gasoline Price in the United States (dollars/gallon), 2000–2020*

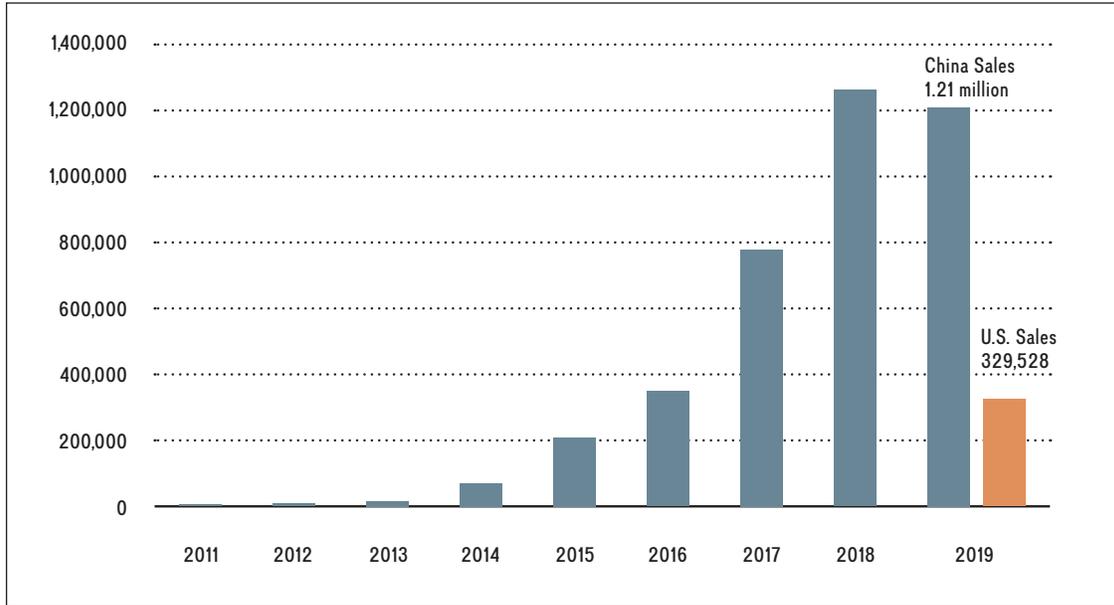


* dotted trendline.

Source: Depiction of publicly available data.

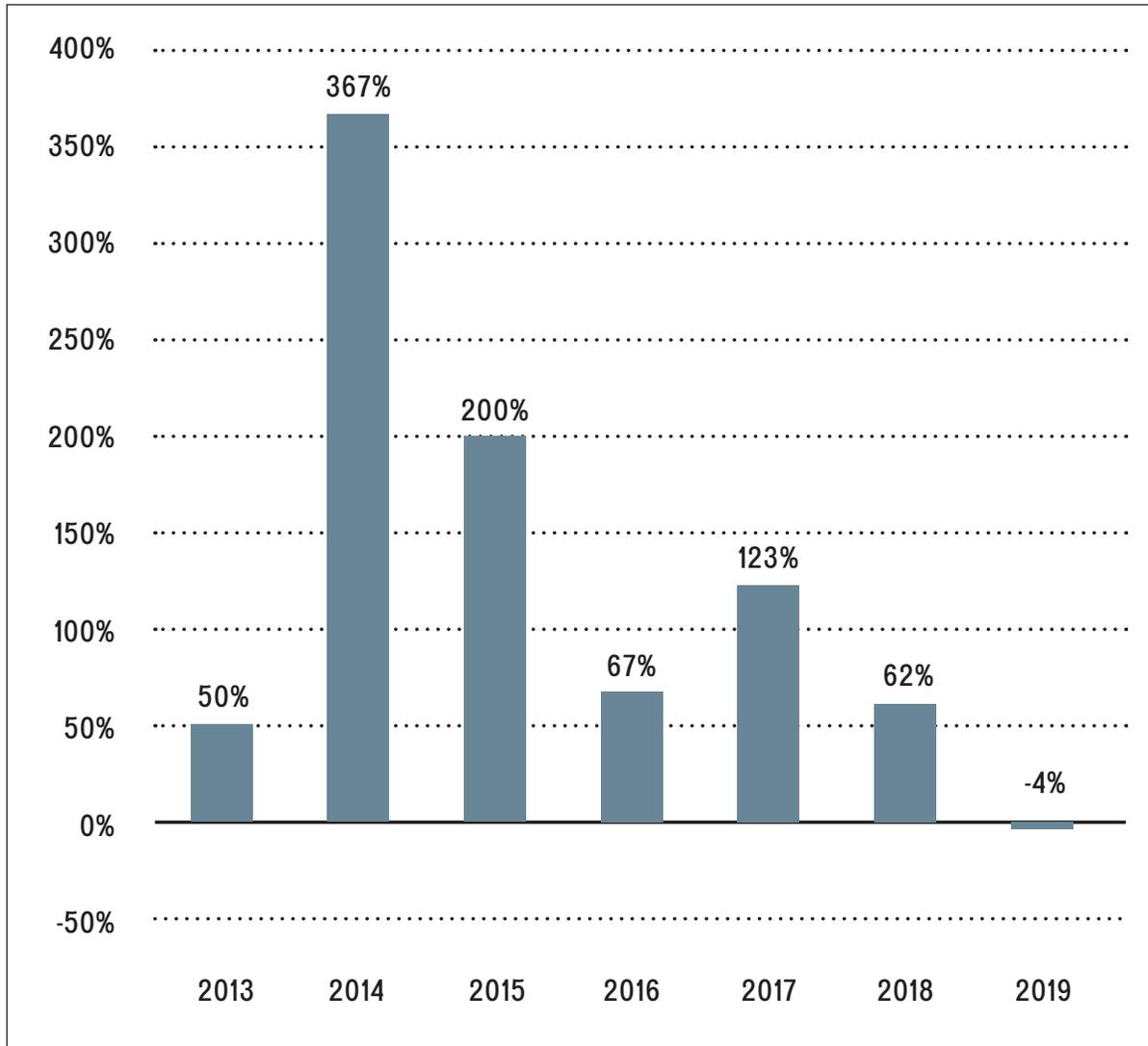
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EXHIBIT 13 Electric Vehicle Sales in China (by units), 2011-2019



Source: Depiction of publicly available data.

EXHIBIT 14 Electric Vehicle Sales Growth Rate in China (percentage change from the previous year), 2013–2019



Source: Depiction of publicly available data.

Telsa, Inc.

Endnotes

- 1 As quoted in “Biography Elon Musk” <http://bit.ly/2vNrIK6>.
- 2 On February 4, 2020, Tesla’s stock market valuation crossed the \$150 billion threshold.
- 3 As quoted in: T. Higgins and S. Pulliman (2018, June 27), “Elon Musk Races to Exit Tesla’s Production Hell,” *The Wall Street Journal*.
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