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Tesla as a Global Competitor: Strategic Control in the EV Transition

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ABSTRACT

In this paper, we assess the implications of Elon Musk's strategic control over Tesla, the pioneering company that has become central to the electric-vehicle transition. We document how, as Tesla's CEO for 16 years, Musk has exercised strategic control to direct the transformation of the company from an uncertain startup to a global leader. Now that Tesla is profitable corporate predators (aka hedge-fund activists) may challenge Musk's strategic control—a possibility of which the CEO is well aware. To retain his control over Tesla as a publicly listed company, Musk depends on holding a sufficient proportion of Tesla's shares outstanding to possess the voting power to fend off predatory value extractors. In addition to accumulating Tesla shares by investing $291.2 million at early stages of the company's evolution, Musk has relied upon massive stock-option grants from the Tesla board, under the guise of "compensation", in 2009, 2012, and 2018, to boost his shareholding and,

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with it, his voting power. Hence the Delaware Court of Chancery's decision in January 2024 to rescind Musk's 2018 stock-option package—by far the largest ever granted to a corporate executive—poses a threat to Musk's strategic control at Tesla. As the "Technoking" of Tesla strategizes to maintain his control over the company's decision-making, anyone concerned with the role that Tesla will play in the evolving EV transition should be asking how CEO Musk might use, or abuse, his powerful position.

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1. Strategic control at Tesla in the electric-vehicle transition

In the global confrontation with climate change, the transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs) is critical. While many major global car producers have been investing in EVs for the past three decades or so, it is only in very recent years that one can say that an EV transition has been underway. In 2019, EV sales—both battery electric vehicles (BEVs) and plug-in hybrids (PHEVs)—were just 2.5 percent of global light-vehicle sales; by 2023, this proportion had jumped to 15.8 percent.[2] BEVs were 73 percent of all EVs sold in 2022 and 70 percent in 2023, with the one-year proportional increase in PHEVs reflecting a jump in sales of these hybrids in China, led by BYD.[3]

U.S.-based Tesla is the global pioneer in BEVs. Founded as Tesla Motors in San Carlos, California in July 2003, by Martin Eberhard and Marc Tarpenning, Tesla has never produced a PHEV, let alone an ICE car. In February 2004, Elon Musk began building a dominant stake in Tesla Motors by investing $6.35 million in the company during its first funding round. As the largest shareholder, he took the role of chairman of the board with, as described below, "final say" over Tesla's strategy and resource-allocation decisions. In October 2008, Musk became Tesla's fourth and longest-running CEO, taking Tesla public on NASDAQ on June 29, 2010. As part of a settlement with the U.S. Securities and Exchange Commission (SEC), Musk was forced to step down as chairman in June 2019 for three years, as a consequence of a tweet the previous August in which he claimed that he had secured funding to take the company private. Rather than re-appoint himself as chairman, in November 2018 Musk promoted Robyn Denholm, who had joined Tesla's board in 2014, to chairwoman.

As Tesla's CEO for 16 years and counting, Musk exercises strategic control over the allocation of the company's resources. Particularly now that Tesla is profitable, however, corporate predators (aka hedge-fund activists) could challenge his control—a possibility of which Musk is well aware. His ability to retain strategic control over Tesla as a publicly listed company depends on his ownership of a high enough proportion of Tesla's shares to provide him with the voting power to fend off a hostile takeover by predatory value extractors. Musk has accumulated Tesla shares, and voting power, by investing $291.2 million of his own money (some of it

[2] Roland Irie, "Global EV sales for 2023," *EV Volumes*, January 22, 2024.
[3] Ibid.

borrowed) at early stages of the company's evolution[4] as well as from enormous stock-option grants from the Tesla board, under the guise of CEO "compensation", in 2009, 2012, and 2018.

Hence the decision in January 2024 by the Delaware Court of Chancery to rescind Musk's 2018 stock-option package, by far the largest ever granted to a corporate executive, poses a threat to Musk's strategic control at Tesla. The court's decision was predicated on revelations that Musk himself, as Tesla chairman, dominated the negotiations for his own stock-option package as Tesla CEO, in part by bestowing bounteous stock options on Tesla board members, undermining their so-called "independence". Musk cemented Denholm's loyalty with option grants that, in her own words, were "life changing", providing her with about $350 million in income over the decade since she joined Tesla's board in 2014.

By using stock-option packages to enable Musk to accumulate large percentages of Tesla's outstanding stock, Tesla's board of directors has played a key role in consolidating Musk's hold on strategic control at the company. In April 2024, ahead of its annual general meeting, and in the face of significant shareholder pushback, Musk and Denholm launched a major campaign to convince Tesla shareholders to re-ratify the rescinded option grant (along with making good on Musk's threat to reincorporate Tesla in the State of Texas). They created a website called "votetesla", which shows retail shareholders how to cast their votes in favor of incumbent management. On June 5, Denholm wrote directly to "fellow owners of Tesla" (i.e., Tesla shareholders), saying that Musk's option package was "obviously not about the money", as Musk was already rich, but rather "to keep Elon focused on Tesla and motivated to achieve the company's incomparable ambitions."[5] Re-ratifying the 2018 option package was about Musk's strategic control, the exercise of which, as Denholm claimed, will determine whether or not the company will realize its "incomparable ambitions".

With his shares as a founding investor and the exercise of stock options, Musk became the richest person in the world, with a reported net worth in 2024 of about $211 billion.[6] Note that Musk's net worth does not include the value of his 2018

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[4] By "pledging" shares as collateral in exchange for credit, Musk was able to use unrealized capital gains on his Tesla stock to purchase, at times of his choosing, additional shares of Tesla (or whatever else).

[5] Tesla DEFA 14, Jun 6, 2024, p. 1.

[6] Saima Andrabi, "Top 10 richest persons in the world. Elon Musk on top. Check the full list here," *The Quint World*, June 3, 2024. Musk's wealth peaked at about $320 billion in November 2021.

option package, even if it is not rescinded, because he has not exercised any of these options (and, as we explain in this paper, probably will not until January 2028). This wealth provides him with immense power to direct the course of the EV transition. It also gives him a potentially inordinate influence over government policy, not only in the United States but also in other nations such as China and Germany where Tesla has made large-scale investments in EV manufacturing. EV batteries, AI, and robotics are all critical technologies for the EV transition, and, through his strategic control of Tesla, Musk has a hand in all of them.

The purpose of this paper is to assess the implications, in the past and going forward, for Tesla, of Musk's exercise of strategic control. We do so from the perspective of the "theory of innovative enterprise" (TIE), an analytical framework that studies the interactions of *strategic control, organizational integration, and financial commitment* as key determinants of the operation and performance of a business corporation.[7]

The exercise of strategic control determines the allocation of corporate resources. How and for whom corporate resources are allocated depends in particular on the abilities and incentives of the "Chief Executive Officer" (CEO), to whom other senior executives are subordinate. Innovation—the generation of higher-quality, lower-cost products than previously available—depends on organizational integration that enables collective and cumulative learning. Organizational integration mobilizes the skills and efforts of people in the corporation's hierarchical and functional division of labor to develop and utilize the corporation's resources, including their own productive capabilities. Financial commitment sustains collective and cumulative learning processes until investments in productive capabilities result in innovative products that, through sales, generate financial returns. For innovation to occur, those who exercise strategic control must understand how to implement the requisite organizational integration and access the requisite financial commitment.

Why do we care about the evolution and impacts of Musk's strategic control? There are at least four reasons:

[7] William Lazonick, "The Theory of Innovative Enterprise: Foundations of Economic Analysis," in Thomas Clarke, Justin O'Brien, and Charles R. T. O'Kelley, eds., *The Oxford Handbook of the Corporation*, Oxford University Press, 2019: 490-514; William Lazonick, *Investing in Innovation: Confronting Predatory Value Extraction in the US Corporation*, Cambridge University Press, 2023.

- It sheds light on the role of corporate leadership in innovative enterprise. How did Tesla, with Musk as CEO, solve the problems of organizational integration and financial commitment to generate higher-quality, lower-cost BEVs?

- It reveals how the listing of a company on the stock market can create problems for the exercise of strategic control to invest in innovative enterprise. How did Musk accumulate voting rights necessary to secure his position of strategic control?

- It provides insight into changes in corporate resource allocation that may occur when, from a position of strategic control, a CEO becomes super-rich. How is Musk's immense wealth affecting the types of resource-allocation decisions that he is making at Tesla?

- It enables those of us concerned about the EV transition to monitor, going forward, whether Musk is abusing his exercise of strategic control. Will Musk make resource-allocation decisions that support, or undermine, Tesla's role in the EV transition?

In the sections that follow, we document the rise of the global EV industry, and the emergence of Tesla, which delivered 1.8 million EVs in 2023, as a global leader. We then document how Musk obtained strategic control over Tesla as a startup and utilized his economic power to carry out Tesla's innovation strategy. Finally, we turn to the ways in which Musk has sought to retain strategic control at Tesla. Musk used enormous stock-option packages designed to grant himself significant proportions of Tesla's outstanding stock, provided he remained committed to Tesla and provided the company succeeded in fulfilling key milestones of its original "master plan" to develop a succession of increasingly affordable electric vehicles. While Musk has succeeded in retaining strategic control thus far, his future as CEO of Tesla is not certain, particularly as he confronts regulatory, legal, and corporate-control challenges. Or possibly, as his own worst enemy, his errors in judgment and defects in personality may do him in.

2. The EV transition

Despite significant and unpredictable periodic disruption, from 1999 to 2023 global automobile production increased at an average annual rate of approximately 2.1

percent.[8] In 2023, auto companies around the world produced 94 million vehicles, with China (32 percent), the United States (11 percent), and Japan (10 percent) representing the majority of global output. New global motor vehicle sales in 2023 were 82 million vehicles, of which 33 percent were in China and 17 percent in the United States.[9]

A critical step toward reducing global greenhouse gas emissions that contribute to climate change is for the United States and China as the largest global producers and consumers of vehicles to transition from ICE vehicles to PHEVs and BEVs that use low-emission or zero-emission energy sources to power them. Many countries and some leading auto manufacturers have stated their intentions to shift to 100 percent EVs by 2035 to 2040.[10] As access to rapid charging expands and battery technologies improve, sales of BEVs will supplant PHEVs.

In some Scandinavian countries 50 to 75 percent of new vehicle sales are EVs, and in the rest of Europe and China EV sales penetration is now in the double digits and climbing.[11] In 2021 China surpassed Europe as the leading market for PHEV and BEV sales, with 3.3 million units sold (49 percent of global EV sales) versus 2.3 million units in Europe (33 percent of global sales).[12] By 2023, sales in China more than doubled to 8.4 million units (59 percent of global sales) versus 3.1 million units in Europe (22 percent), and 1.4 million units in the United States (10 percent).[13] Insofar as a rapid transition to EVs is underway, China is leading the transition and, given its large domestic market plus its recent moves to export EVs and manufacture them abroad, China is very well positioned to remain the global leader in the future.

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[8] International Organization of Motor Vehicle Manufacturers (OICA), "Production Statistics," *OICA*, various years. The Great Recession reduced vehicle production approximately 16 percent in 2009. The Covid-19 pandemic reduced production approximately 20 percent in 2020 relative to 2017 production of 97 million units.

[9] India (6 percent), Japan (5 percent), and Germany (4 percent) rounded out the top five auto markets in 2023.

[10] Brad Plumer and Hiroko Tabuchi, "6 automakers and 30 countries say they'll phase out gasoline car sales," *New York Times*, November 9, 2021; Joe Hernandez, "COP26 sees pledges to transition to electric vehicles, but key countries are mum," *NPR*, November 10, 2021.

[11] International Energy Agency, "Global EV Outlook 2022," *IEA*, p.15.

[12] International Energy Agency, "Electric Vehicles," *IEA*, September 2022.

[13] Ibid; Mark Kane, "US: All-electric car sales surged in January 2023—7% market share," *InsideEVs*, March 18, 2023; Mark Kane, "U.S. EV sales ended 2023 at 1.1 million," *InsideEVs*, January 18, 2024. The figure of 1.4 million includes sales of PHEVs.

Lithium-ion batteries

Enabling the rapid shift toward high performance PHEVs and BEVs is the availability of innovative rechargeable lithium-ion (Li-ion) batteries. After decades of development in corporate, university, and government research labs, commercial production of Li-ion batteries began in 1991, with Japan-based Sony producing Li-ion batteries to power its Handycam camcorder. Li-ion batteries had superior energy density and cycle life compared to the alternative NiMh (nickel metal hydride) or lead-acid batteries available.

Superior energy density means that Li-ion batteries store more energy per unit weight, making them suitable for more demanding applications versus current battery technologies. Lithium-ion batteries subsequently found applications in all sorts of consumer electronics, including cell phones, power tools, laptops, and so on. But notably it was not until 2019, with large-scale global EV production finally taking off, long after Li-ion batteries had enabled revolutionary "smart" cell phones and shrinking portable electronics, that the pioneering scientific work of John Goodenough, Stanley Whittingham, and Akira Yoshino in Li-ion batteries was honored with a Nobel Prize in chemistry.[14]

Battery technologies generally combine a cathode (positively charged), anode (negatively charged), and electrolyte (in this case, typically lithium salt) comprised of one of many different materials to store energy. The batteries are packaged in cylindrical, prismatic, or pouch forms.[15] The current chemistries dominant in the automotive industry utilize lithium nickel manganese cobalt (NMC), lithium nickel cobalt aluminum oxide (NCA), and lithium iron phosphate (LFP) chemistries. As shown in Figure 1, each chemistry makes different trade-offs in terms of cost, safety, and performance—parameters that reflect the availability of materials required for their production, their relative energy density, their C-Rate (the speed of charge/discharge), and expected life span (or maximum charge/duty cycles).

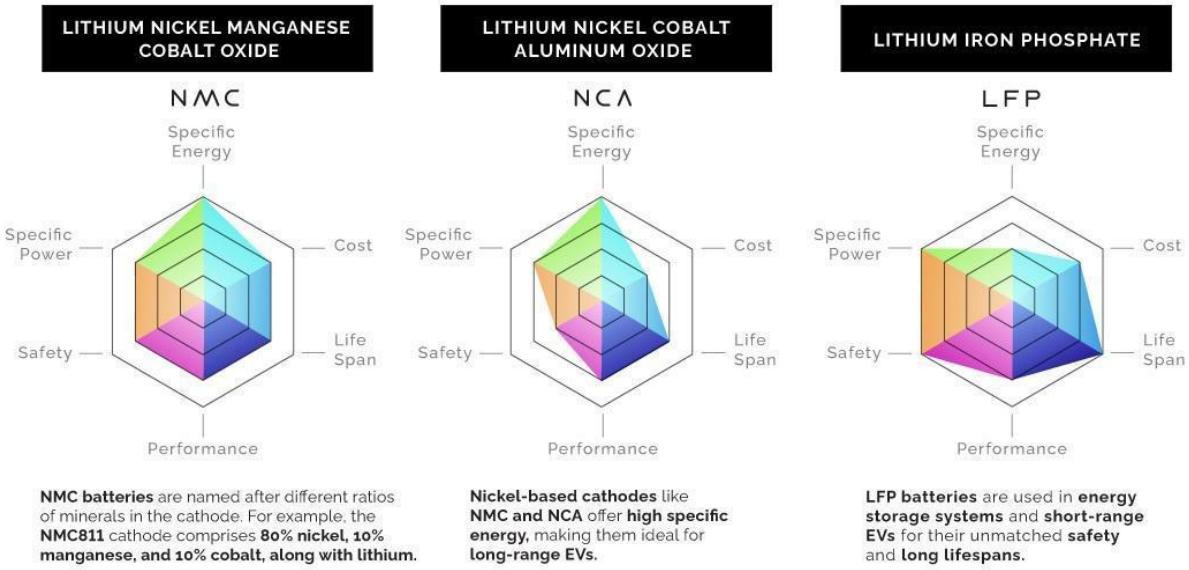
NMC batteries are high performance, capable of long-range. In utilizing nickel and cobalt, however, NMC faces mineral availability challenges, and it has a shorter cycle life than other chemistries. NCA batteries offer higher performance and longer

[14] Royal Swedish Academy of Sciences, "The Nobel Prize in Chemistry, 2019," The Nobel Prize (accessed June 2, 2024); Robert D. McFadden, "John B. Goodenough, 100, dies; Nobel-winning creator of the lithium-ion battery," *New York Times*, June 26, 2023.

[15] Govind Bhutada, "The six major types of lithium-ion batteries: A visual comparison," *Elements*, April 18, 2023.

cycle life than NMC batteries. But as a less stable chemistry, it also requires incorporation of more safety components at the pack level. LFP batteries trade off maximum performance for long cycle life. Lower cost reflects relatively abundant material availability and more stable chemistry that requires fewer safety components at the pack level.[16]

Figure 1: Types of Lithium-ion batteries and performance envelope



Source: adapted from Govind Bhutada, Christina Kostandi, and Clayton Wadsworth, "The six major types of lithium-ion batteries: A visual comparison," *Elements*, April 18, 2023.

LFP batteries were invented in the United States by the aforementioned John Goodenough in 1996, but they were commercialized for EVs by Chinese firms such as CATL and BYD. By agreeing in 2010 to limit production of LFP batteries to China's domestic market, Chinese firms were able to license the technology for free from the patent-controlling LiFePO4+C consortium, which consisted of Hydro Quebec, Johnson Matthey, University of Montreal, and National Center for Scientific Research (CNRS).[17] The controlling patents expired in 2022, permitting Chinese firms to export LFP batteries or establish battery manufacturing abroad, which is now underway as a result of "Western" auto firms partnering with Chinese battery manufacturers to "on shore" Li-ion production in the United States, with

[16] Tom Lombardo, "Why EV manufacturers are switching from NMC to LFP batteries," *Engineering*, September 30, 2022; Jerry Huang, "A comparison of NMC/NCA lithium ion battery and LFP battery," *POWorks*, November 6, 2020.

[17] Steve LeVine, "Why Elon Musk has bet on Asian battery makers over American battery startups," *The Information*, July 18, 2021.

billions of dollars in U.S. government funding support under the Infrastructure Law and Inflation Reduction Acts.[18]

The availability of a range of affordable EVs as well as Li-ion battery chemistries manufactured at scale suitable to power them is a critical part of this early stage of the EV transition. The existing global EV battery supply chain is, however, currently incapable of producing enough batteries to replace, hypothetically, the output of ICE vehicles in the global auto industry. At present, Chinese firms dominate Li-ion battery manufacturing globally and much of the supply chain.[19] Even with planned investments in battery manufacturing occurring in several other countries, China is expected to retain a dominant share of EV-battery manufacturing capacity in the future.[20]

There are ways in which the need for raw resource extraction for battery manufacturing can be reduced. EV batteries at the end of their useful life may be repurposed into new applications, such as grid storage.[21] Recycling battery materials can reduce the need to extract growing amounts of raw materials. Decisions by manufacturers to make use of a variety of battery chemistries or to rely on relatively resource-abundant battery chemistries like LFP reduces the demand for relatively resource-scarce chemistries like NMC and NCA.[22]

As the EV industry has attracted more entrants and begun to scale more rapidly, the cost of Li-ion batteries has rapidly declined (see Figure 2). The overall cost of Li-ion battery packs (sensitive primarily to the cost of battery cells) have fallen approximately 79 percent since 2013—despite overall costs *rising* slightly in 2022. Based on disaggregated data, passenger EV battery pack costs are about $118/kWh, suggesting that existing auto and battery makers are close to achieving cost "parity"

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[18] Paul Lienert, "As electric cars take off, makers pledge $11.3 billion for US lithium iron phosphate," *Reuters*, June 23, 2023.

[19] Bruno Venditti, "The top 10 EV battery manufacturers in 2022," *Visual Capitalist*, October 5, 2022; Tessa Di Grandi, "Visualized: The EV mineral shortage," *Visual Capitalist*, February 8, 2022.

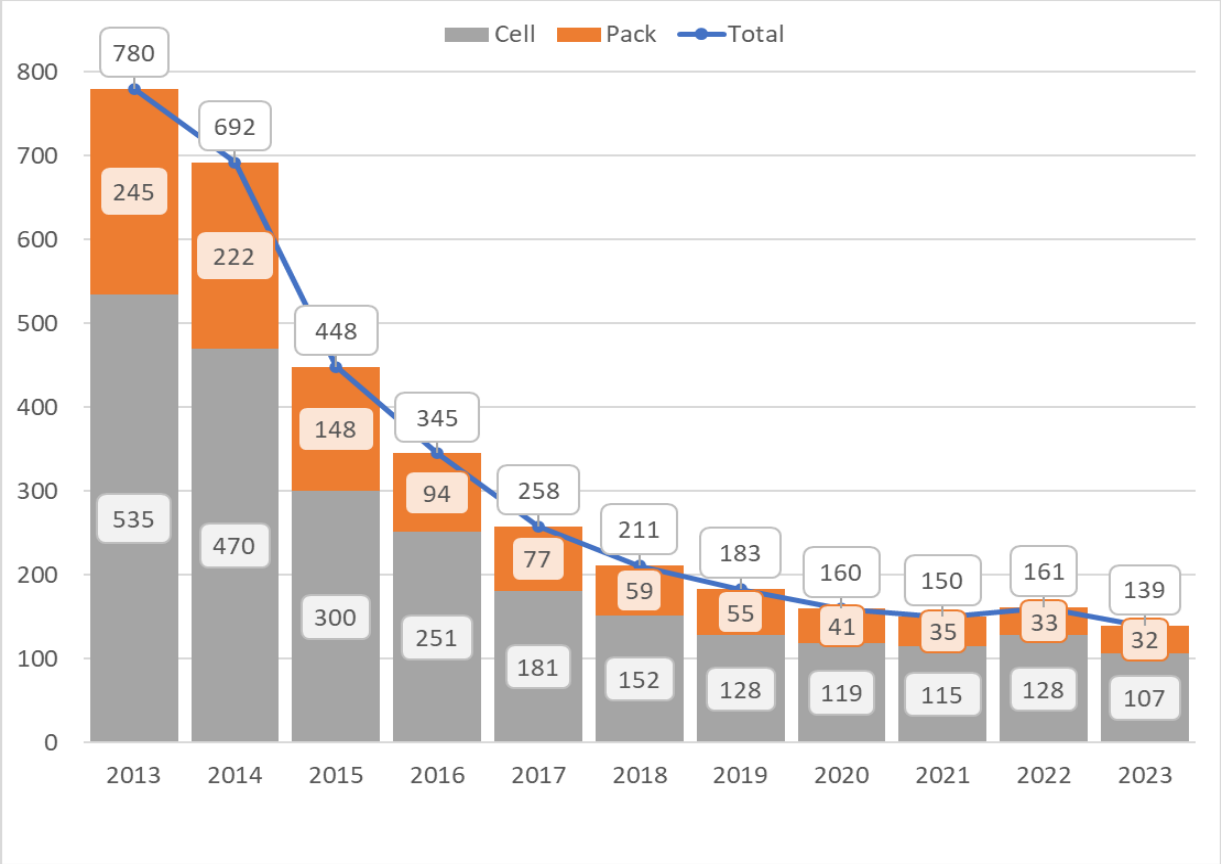
[20] Govind Bhutada, "Mapped: EV battery manufacturing capacity, by region," *Visual Capitalist*, February 28, 2022; Govind Bhutada, "Visualizing China's Dominance in Battery Manufacturing (2022-2027P)," *Visual Capitalist*, January 19, 2023.

[21] Daniel Bleakley, "1300 recycled electric vehicle batteries used for biggest grid-scale storage system of its kind," *The Driven*, February 8, 2023.

[22] Jessica Dunn, "Are there enough materials to manufacture all the electric vehicles needed?" Union of Concerned Scientists, November 15, 2022.

with ICE vehicles, believed to occur when battery pack prices decline to about $100/kWh.[23]

Figure 2: Volume-weighted, inflation adjusted, average Li-ion battery pack and cell price split, 2013-2023



Source: adapted from Oktavia Catsaros, "Lithium-Ion battery pack prices hit record low of $139/kWh," *BloombergNEF*, November 26, 2023.

Li-ion battery pack costs have fallen rapidly, by close to 90 percent in inflation-adjusted terms since 2008.[24]As a rule of thumb, current EVs can travel approximately 3 miles/kWh, with highly efficient models traveling closer to about 5

[23] Steven Loveday, "EV battery cell & pack prices dropping at surprising rate," *InsideEVs*, December 2, 2021. As a. rough approximation, each 100 miles a BEV travels requires 30 kWhs. A 100-kWh battery pack, capable of about 300 miles, would cost about $10,000 at "parity"; LeVine, "Why Elon Musk," notes CATL's battery costs as $80/kWh (without specifying if this is at the cell or pack level).

[24] U. S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Fact of the week," DOE, August 4, 2024.

miles/kWh.[25] To permit a range of 300 miles or more, EVs generally require battery packs with usable capacity of about 75 to 100 kWhs.[26] Even at today's lower prices, such battery packs may cost $8,500-$11,000 each—a significant amount of an EV's list price.

The rise of China's EV industry along with availability, cost, and safety concerns have contributed to the rapid ascension of LFP batteries as the dominant EV battery chemistry in recent years. But as batteries are further integrated into consumer, grid, and transportation applications, new chemistries or technologies may emerge that will disrupt, and in some cases destroy, existing investments in supply chain and product development.[27]

Rapid charging

Given the ubiquity of electric energy infrastructure, EVs can already be "refueled" (i.e. recharged) anywhere an outlet is available. But with their very large on-board batteries, EVs plugged into standard outlets can take, hypothetically, days to fully recharge a depleted battery. The length of time required to recharge EVs depends upon the charging capabilities of the EV and the output of the available outlet.

Table 1 provides information about types of charging stations and recharging times drivers might expect from them. PHEVs, with their smaller on-board battery packs and limited electric range, can be recharged relatively quickly on standard outlet chargers (i.e. "level 1"), or not at all, given their on-board gas generators. BEVs, with battery packs that range in size from about 40 kWhs to well over 100 kWhs (for example, in larger trucks and SUVs), require substantially longer recharge times, depending on the charging speed available. For regular needs, level 1 and level 2 chargers are adequate for recharging EVs used to drive the approximately 40 miles

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[25] For example, the Tesla Model 3 is rated for about 4.5 miles/kWh, while the Ford Lightning pickup truck is rated for about 2.3 miles/kWh.

[26] Lithium-ion battery packs are designed to prevent 100 percent recharge/discharge, which normalizes performance, extends battery life, and boosts efficiency. "Usable" capacity is the capacity that determines the real-world range of a given EV.

[27] For example, it is expected that solid-state batteries and sodium-ion batteries will be commercialized, altering the price-performance relation across a range of battery uses. See Casey Crownhart, "What's next for batteries," *MIT Technology Review*, January 4, 2023. For the argument that the world has enough lithium for the EV transition, but that production needs to be scaled up, see Hannah Ritchie, "Does the world have enough lithium to move to electric vehicles?" *Sustainability by Numbers*, January 25, 2023.

many Americans drive each day, on average.[28] Given their lower cost, level 1 and level 2 chargers can be purchased and installed in virtually any residential or commercial location.

Level 3 charging is essential for drivers without access to other charging options where they reside, or who must travel in excess of the BEV's range in a given day to reach a destination. Li-ion batteries recharge at a diminishing rate, faster when depleted and slower when near a full charge. State-of-the-art BEVs connected to level 3 chargers can recharge a nearly depleted Li-ion battery to 80 percent in about 20 to 30 minutes, the remaining 20 percent taking much longer.[29] Chargers that deliver, and EVs that accept, even higher power will shorten recharge times and improve the convenience of EVs for long-distance travel.[30]

Table 1: Charger types and charging speeds

Type	Level 1	Level 2	Level 3/DC Fast
Power output	1 kW	7-19 kW	50-350 kW
Voltage	120V	200V-240V	400V-1,000V
PHEV recharge time	5-6 hours	1-2 hours	N/A
BEV recharge time	40-50 hours	4-10 hours	20-60 minutes
Miles per hour	2 to 5	10 to 20	180 to 240
Typical locations	Home	Home, Workplace, and Public	Public

Source: adapted from U.S. Department of Transportation. "Charger types and speeds," DOT *(*accessed August 19, 2024)

Hence, along with continued innovation in batteries that improve upon their safety and performance, a critical step toward electrifying transportation networks around the world is expanding public access to high-quality charging locations, particularly public rapid charging stations of the level 3 type.[31] Ideally, high-quality rapid

[28] U.S. Census Bureau, "Census Bureau estimates show average one-way travel time to work rises to all-time high," *US Census*, March 18, 2021.

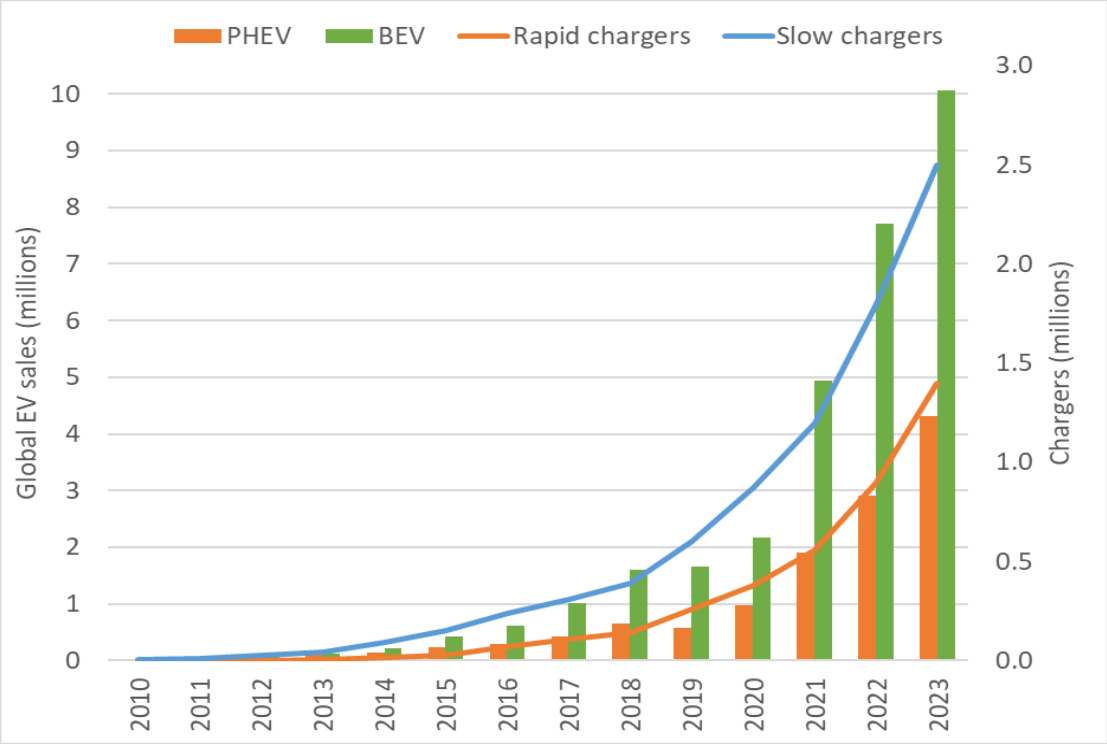
[29] Jonathan Gitlin, "You won't be confused about electric vehicle charging after reading this," *Arstechnica*, July 28, 2022.

[30] An alternative to rapid charging is battery swapping (a depleted pack is quickly replaced with a fully charged pack). One EV company, China-based NIO, has taken this approach.

[31] High-speed rapid chargers are critical because they permit long-distance travel—that is, longer than the on-board battery pack allows. Aside from rapid charging, companies may opt

chargers are connected to zero-emission and renewable electric power sources, offer superior power output, reliability, user experience, and location. Current PHEVs mitigate the lack of access to rapid charging by permitting use of the world's existing "rapid charging" infrastructure in the form of gas stations—an obviously incomplete EV transition. As rapid charging infrastructure becomes more readily available, the EV industry will likely transition away from PHEVs to BEVs. Figure 3 illustrates that this trend is already underway, with BEV sales exceeding PHEV sales as charger availability improves.

Figure 3: Global PHEV and BEV sales and rapid charge stations, 2010-2023



Source: International Energy Agency, "Global EV Data Explorer," *IEA*, April 23, 2024.

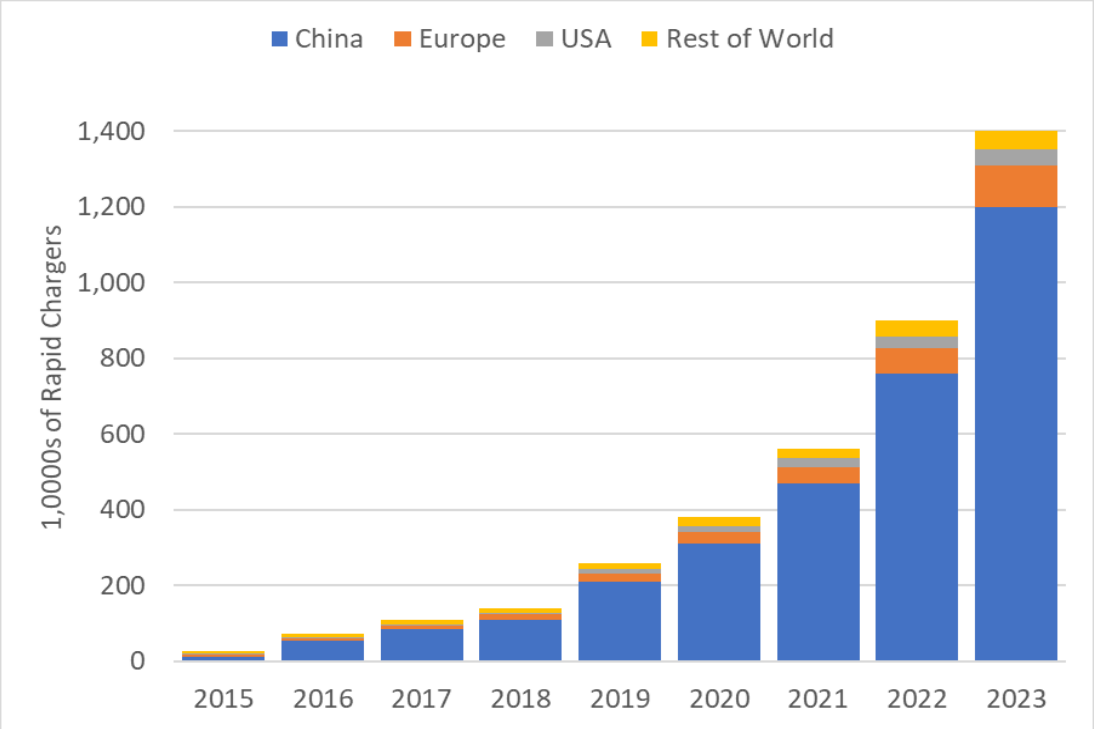
Figure 4 shows that China, which opted to build out a public EV charging network ahead of EV production and demand, has the largest installed rapid charging network.[32] In 2022, China had 760,000 total installed high-speed chargers compared

to install battery swap stations that reduce time to a complete re-charge to minutes. Nio in China is an auto producer that is investing in battery swap stations. They also advertise a recharging service delivered by a mobile fleet that goes to where the customer is. Another company is Ample, building battery-swap stations for Uber. See Maurizio Di Paolo Emilio, "Battery swapping supports U.S. electrification goals," *EETimes*, June 28, 2023.

[32] Colin McKerracher, "EV charging data shows widely divergent global path," *Bloomberg New Energy Finance*, April 15, 2021.

to 70,000 installed in Europe and 28,000 in the United States.[33] To expand access to a high-quality rapid charging network, the U.S. government, through the National Electric Vehicle Infrastructure program, is giving out $5 billion in grants. To ensure that EV drivers will be unlikely to arrive at a charging station only to discover it inoperable, the grants require network developers to meet "uptime" requirements of 97 percent.[34]

Figure 4: High-speed chargers, selected countries, 2015-2023



Source: International Energy Agency, "Global EV data", *IEA50* (accessed August 14, 2024).

Globally, Tesla had 3,476 rapid charging locations in 2021, increasing to 5,952 at the end of 2023. In 2023, Tesla had 1,600, or about 24 percent, of its Supercharger stations installed in China, where vehicles sold by competing EV producers can use

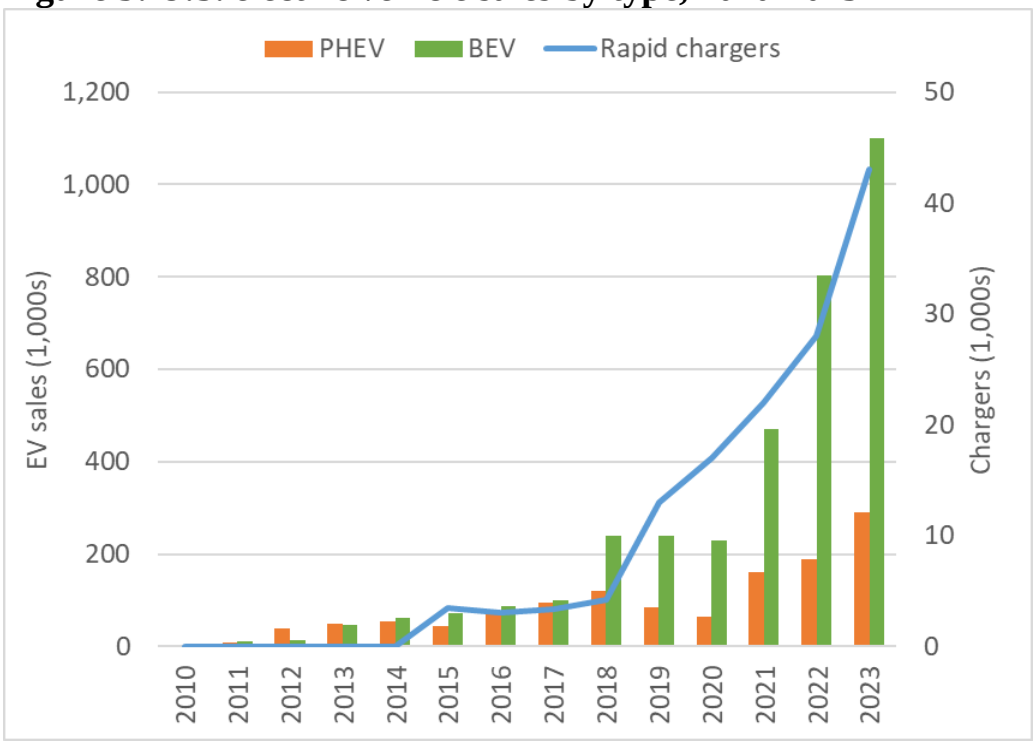
[33] International Energy Agency, "Trends in charging infrastructure," *Global EV Outlook 2023* (accessed August 19. 2024).

[34] Jeff St. John, "EV chargers have a big reliability problem. Can the government fix it?" *CanaryMedia*, December 11, 2023; National Archives, "National Electric Vehicle Infrastructure Standards and Requirements," *Federal Register*, February 28, 2023; David Ferris, "Why America's EV chargers keep breaking," *Politico*, April 12, 2023.

them.[35] Tesla claimed in its 2023 "Impact Report" that, powered by 100 percent renewable energy, its Supercharger network had 99.97 percent uptime.[36]

Expansion of rapid-charger access and EV sales are mutually reinforcing trends, as illustrated by the experience of the United States in Figure 5. Tesla's business strategy to invest in a proprietary nationwide supercharger network has contributed to the company's dominant position in the U.S. EV market, by removing a key barrier to customer adoption of EVs. At the end of 2023, Tesla's vehicles comprised 64 percent of all registered EVs in the United States.[37] At the same time, Tesla has driven development of level 3 charging infrastructure (while also offering level 2 chargers to homes and businesses), and in 2023 offered 61.2 percent of available rapid-charging ports.[38]

Figure 5: U.S. electric vehicle sales by type, 2010-2023



Source: International Energy Agency, "Electric vehicles," *IEA50*, June 24, 2024.

[35] Rebecca Bellan, "Tesla expands non-Tesla Supercharger access to China," *TechCrunch*, April 25, 2023.

[36] Tesla, "Impact Report 2023," *Tesla*, p. 40 (accessed August 19. 2024).

[37] Abby Brown, Jeff Cappellucci, Alexia Heinrich, and Emma Cost, "Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: Fourth Quarter 2023," National Renewable Energy Lab, May 2024, p. 9.

[38] Ibid., p. 11.

Rival company ChargePoint has the most expansive EV charging network in the United States, but it is comprised primarily of level 2 chargers. Volkswagen's Electrify America, Tesla's nearest rival for level 3 charging, had just 10.6 percent of rapid charging ports.[39] In 2022, Tesla opened its proprietary Supercharger network to its competitors, a move that will solidify its dominance. GM, Ford, and Rivian are planning to equip future EVs with Tesla's NAC plug and partner with Tesla to offer Supercharger access to their customers, along with 13 other automakers.[40] Tesla's aggressive and rapid expansion of its level 3 charging network has positioned the company as the U.S. standard-setter in rapid charging.[41]

3. Emergence of Tesla as a global leader

Tesla's BEV sales growth of approximately 50 percent each year since 2013 has been accompanied by a buildout of its Supercharger network at a rate of 62 percent (Figure 6), with Tesla utilizing its sales data and knowledge of its customers' travel patterns to help determine best site locations.

In the United States, the number of EV product offerings expanded from five in 2011 to 55 in 2019, with the most popular PHEVs by cumulative sales through 2019 being GM Volt, introduced in 2010, with 156,733 units and Toyota Prius, introduced in 2012, with 116,927 units. Amongst popular BEVs, Nissan Leaf, introduced in 2010, and Chevy Bolt, introduced in 2016, were relatively successful models, with cumulative sales through 2019 of 141,888 and 58,208 units, respectively.[42]

The data indicate that BEVs are the future. The companies that will lead in the EV transition will be those that manufacture and sell high-quality, low-cost BEVs, with some type of proprietary access to charging infrastructure as a source of additional competitive advantage. Generally speaking, "high quality" BEVs will be safe, reliable, and high-performance—capable of traveling long distances on a single charge with state-of-art software for information, communication, and diagnostic purposes. Thus far, Tesla and BYD are the clear BEV leaders, but as the full EV transition takes place, the number of leading global competitors will increase.

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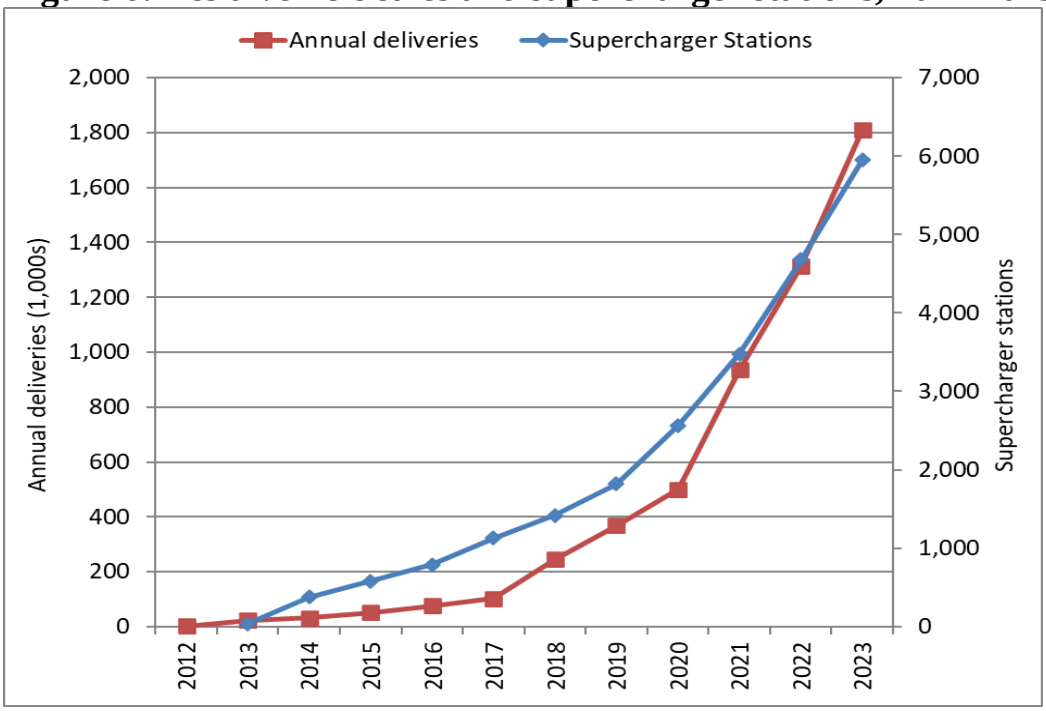
[39] Ibid., pp. 11-12.

[40] CBS, "Rivian joining Tesla charging network, inches closer to becoming industry standard," *CBS*, June 20, 2023; Michael Wayland, "GM to use Tesla charging network, joining Ford in leveraging the EV leader's tech," *CNBC*, June 8, 2023; Brown et al., "Electric Vehicle Charging," p. 9.

[41] Ferris, "Why America's EV chargers keep breaking".

[42] Transportation Research Center at Argonne National Laboratory, *"U.S. Plug-in Electric Vehicle Sales by Model," Department of Energy, accessed 3/21/2024.*

Figure 6: Tesla vehicle sales and supercharger stations, 2012-2023



Source: Tesla shareholder letters, various quarters.

In 2023, Tesla's Model Y, the company's fifth BEV, was the bestselling vehicle—ICE or EV—in the world. Tesla sold 1.2 million Model Ys, surpassing Toyota's Corolla sedan and RAV4 SUV, both ICE vehicles which sold about one million units each.[43] Starting at $45,000 before incentives or subsidies, the base rear-drive Model Y "long range" is rated for 320 miles of range, with 308 miles available from an all-wheel drive variant that starts at $48,000. It can accelerate from 0-60 mph in a sports-car like 3.5 seconds and return an estimated 122 miles per gallon equivalent (MPGe).

The Toyota Corolla, which starts at half the price of the Model Y, provides an estimated 35 MPG and 462 miles of range. The Toyota RAV4 starts at $28,000 and provides an estimated 30 MPG and 435 miles of estimated range.[44] For those wanting better fuel efficiency, Toyota offers a hybrid variant of the Corolla for around $30,000, and plug-in hybrid version of the RAV4 for about $50,000. Neither could keep up with the Tesla in a sprint, and neither offer the futuristic or premium features of Tesla's top selling model. With federal subsidies and other incentives

[43] Nick Berg, "World's best-selling car Is the Tesla Model Y," *Hagerty*, January 26, 2024; José Pontes, "World EV sales report — Tesla Model Y is the best selling model in the world!," *Cleantechnica*, February 2024.

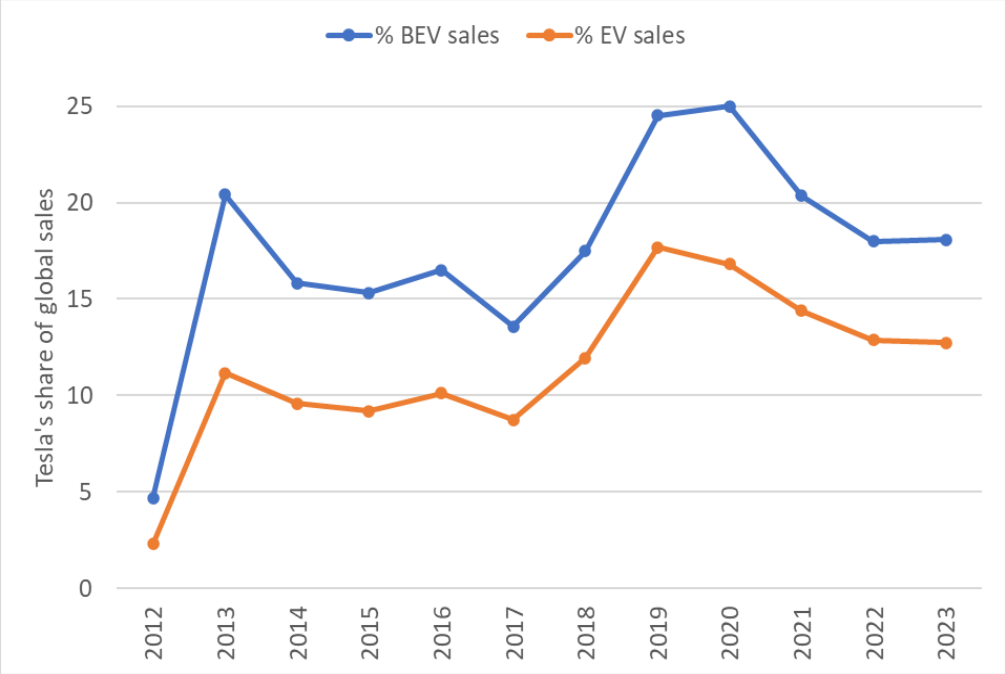
[44] In their top trims, the Corolla hybrid can reach $30,000, the Rav4 PHEV $50,000.

that vary from state to state in the United States, the Model Y (and other qualifying EVs) can be purchased with between $7,500 and $15,000 in rebates.

The growth of Tesla

Founded in 2003 in San Carlos, California, on the San Francisco Bay, between Palo Alto and San Francisco, Tesla in 2023 approached 20 percent of all global BEV sales (Figure 7),[45] followed closely by BYD of China, Volkswagen of Germany, and GM's Wuling (with Wuling's sales primarily in China). The same year, Tesla had a dominant 55 percent market share of BEV sales in the United States.[46] Tesla has maintained an EV market share of about 66 percent in the United States, on average, since it released its popular Model 3 in 2016 and Model Y in 2020.[47]

Figure 7: Tesla's global market share, 2012-2023



Sources: International Energy Agency, "Global EV Outlook" (various years); *Roland Irle, "Global EV sales for 2023,"* *EV-Volumes*, January 22, 2024. Tesla 10-K filings.

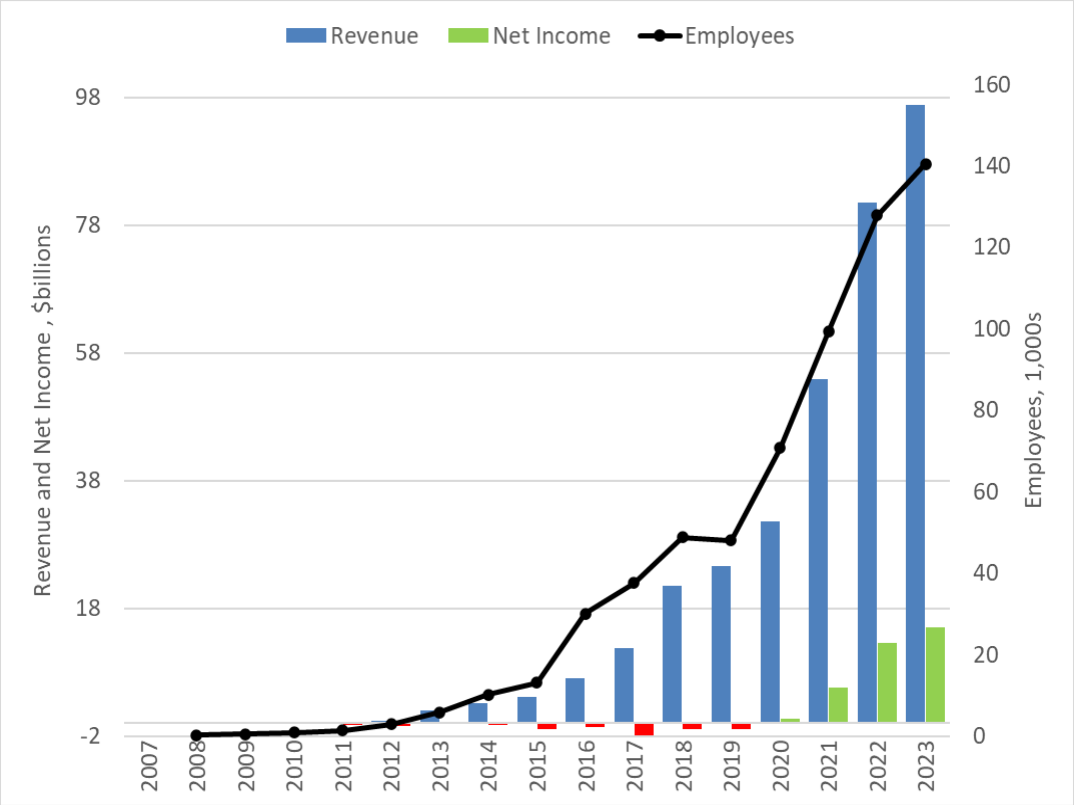
[45] Marcus Lu, "Visualizing global electric vehicle sales in 2023," *The New Diplomat*, March 11, 2024.

[46] Cox Automotive, "A record 1.2 million EVs were sold in the U.S. in 2023, according to estimates from Kelley Blue Book," *Cox Automotive*, January 9, 2024; Tesla's US market share was 64 percent in 2022. Kane, "US: All-Electric car sales surged."

[47] Authors' calculations, U.S, Department of Energy, "U.S. Plug-in Electric Vehicle Sales by Model, 2011-2019," Alternative Fuels Data Center (accessed June 4, 2024).

Figure 8 illustrates Tesla's growth trajectory in terms of revenues, net income, and employment. Tesla has demonstrated that BEV production at scale is profitable, and that significant demand for innovative EVs exist. What is more, in 2023, Tesla built 1.8 million BEVs, which would place it amongst the world's top 15 vehicle producers (by 2017 standards, at least, the most recent year for which data are available).[48] In 2023, Tesla generated $15 billion in profits on $97 billion in revenues. Employment has grown 33 percent each year, on average, since 2015. With 140,473 employees at the end of 2023, Tesla had more than doubled in size by employment since 2019, when it began producing its lowest-cost BEVs at its Shanghai, China Gigafactory. With a major plant in Germany and one planned in Mexico, Tesla has emerged as a global producer of electric vehicles competing in the world's largest auto markets.

Figure 8: Tesla's revenue, net income, and employees, 2010-2023



Source: Tesla 10-K filings, various years. Red bars indicate years with negative net income.

The growth of Tesla was a result of the production of a succession of innovative BEVs. Tesla initially produced a high-cost, low-volume sports EV, the Roadster,

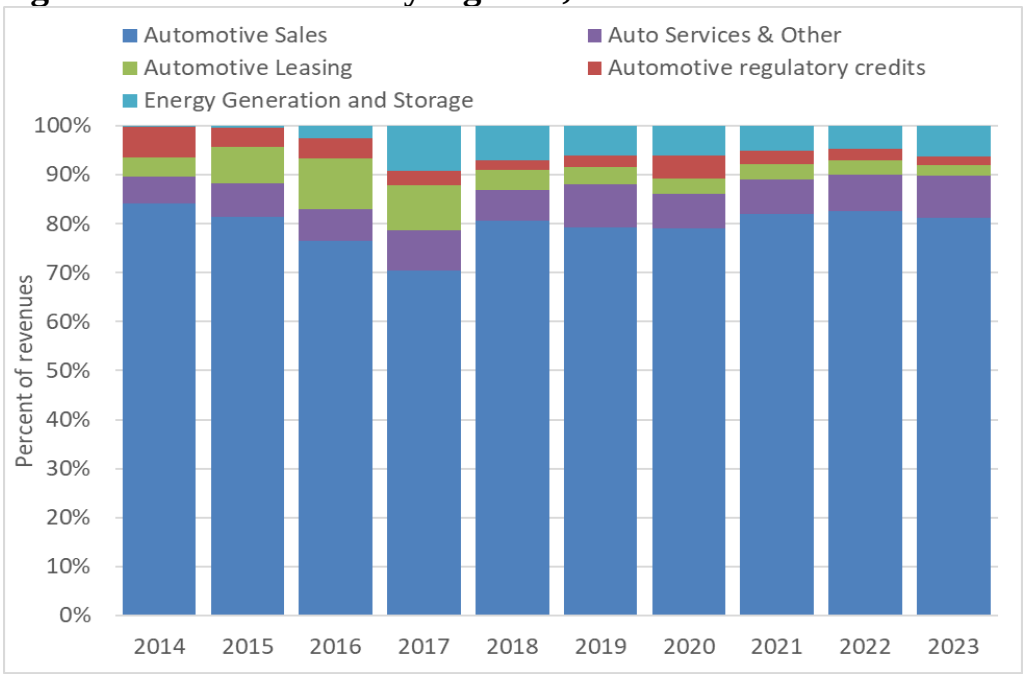
[48] International Organization of Motor Vehicle Manufacturers, "2017 Production Statistics," *OICA* (accessed June 4, 2024).

before targeting premium auto market segments with vehicle prices in the $50,000-$100,000 range with the Model S. It then reinvested those revenues to finance the development and mass production of its third generation EV, the lower-cost (approximately $35,000), higher-volume Model 3 in 2016. The Model 3 and its compact SUV variant, the Model Y, have been Tesla's most successful EVs so far.

Tesla's vehicles generally have combined sports-car like acceleration, a minimum range of 250 miles, hardware that enables advanced "autopilot" features, and 5-star crash ratings. Tesla's vehicles also feature "over the air" software update capabilities that make it possible to upgrade vehicle features or, in some cases, perform recalls without visits to a service center. To overcome consumer uncertainty related to purchasing, not just a BEV, but one from an unproven auto startup, Tesla offered incentives like free rapid charging or guaranteed used resale prices for the Model S. Its direct sales and service model streamlined the purchase, delivery, and maintenance experience for its customers.

As Tesla has grown, it has applied its experience and learning to expand its product offerings, including solar power and energy generation and storage products, which target both residential and commercial customers. Despite its diversification, Figure 9 reveals that Tesla owes its growth, thus far, to its success as an EV producer.

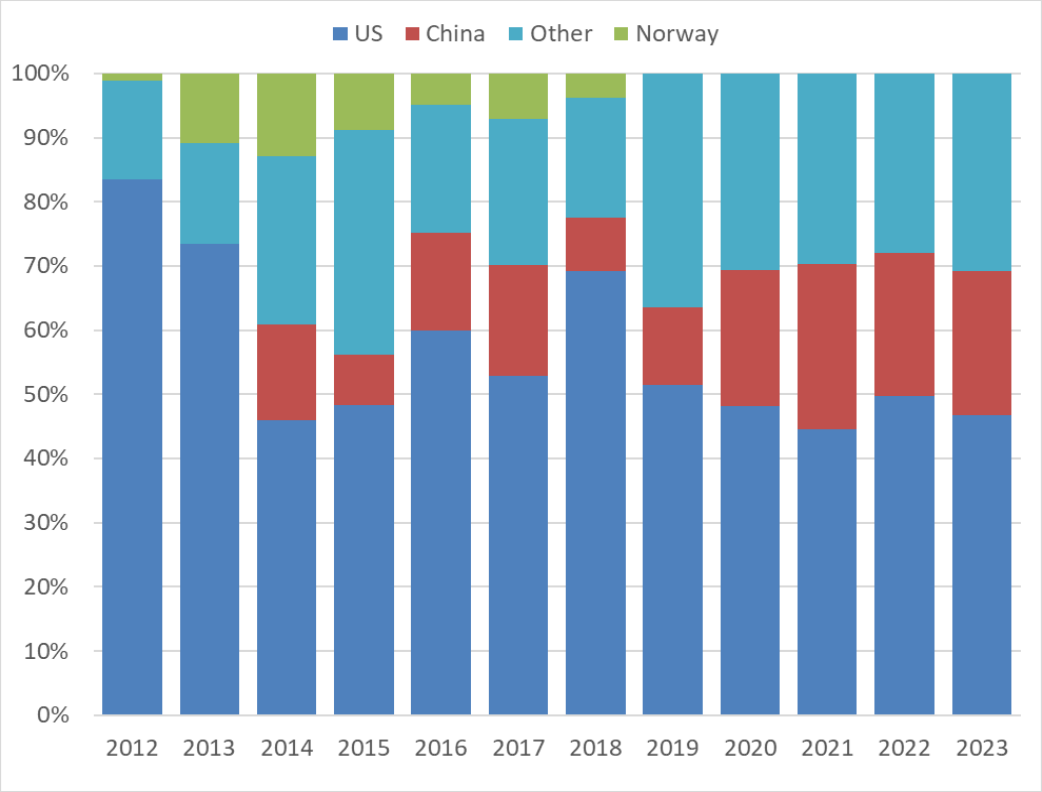
Figure 9: Tesla revenue by segment, 2014-2023



Note: "Auto services & Other" includes paid supercharging. Energy generation and storage includes solar energy and energy storage revenues.
Source: Calculation by authors, Tesla shareholder letters, various quarters.

Even before Tesla began diversifying its product offerings, it sold its EVs in foreign markets. Between 2008 and 2012, Europe was a significant source of Tesla's revenues. In more recent years, China has emerged as a key market for Tesla, representing over 20 percent of revenues. For now, the United States remains Tesla's largest market (Figure 10).

Figure 10: Tesla sales by region, 2012-2023



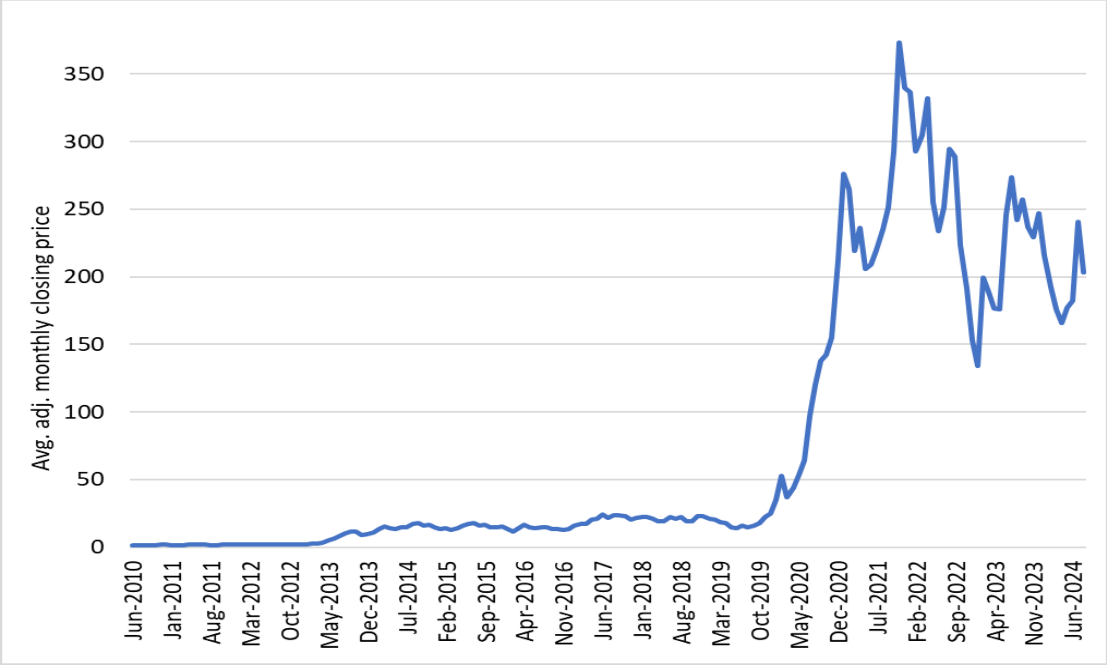
Source: Tesla 10-K filings, various years.

Tesla completed its initial public offering (IPO) in 2010. After releasing the Model S in 2012, Tesla posted a net profit—for the first time—in Q1 2013. Notwithstanding the fact that Tesla did not begin posting regular profits until the end of 2019,[49] Tesla's stock price and market capitalization subsequently soared (Figure 11), and its shares were added to the NASDAQ 100 stock index in July 2013. Tesla's next stock-price boom came from the release of the much-anticipated Model 3, Tesla's third generation vehicle and fourth EV. Tesla's stock price shot up over 50 percent between 2016 and 2018, even as the company booked billions in losses. Tesla's meteoric share price increase after 2019 was driven by its achievement of regular

[49] Tesla also posted a net profit in Q3 2016, and Q3 2018.

profits, which also qualified it for addition to the S&P 500 stock index in December 2020.

Figure 11: Tesla's average adjusted monthly stock price, June 2010-August 2024



Source: Yahoo!Finance (accessed August 15, 2024)

Strong sales performance during the Covid-19 pandemic, a period during which other automakers struggled, also contributed to Tesla's stock price peaking at approximately $407 per share on November 1, 2021, granting it a stock market valuation of over $1 trillion.[50] Tesla became the sixth out of just seven U.S. companies to ever achieve this lofty level, and it was the only automaker to ever do so. The source of Tesla's ability to produce such incredible "shareholder value" was its growth, driven by innovation and, as a result, its strengthening position amongst other leading vehicle manufacturers, be they producers of ICEs or EVs.

As Tesla's largest shareholder, CEO Elon Musk became the world's richest person. Many other Tesla directors, executives, and employees compensated with Tesla stock options became extremely wealthy during this stock market boom. Even at a "depressed" market capitalization of $609 billion on August 16, 2024, stock-market traders have deemed Telsa's shares to be more valuable than those of Ford, GM, Stellantis (Chrysler), and Toyota combined.

[50] Neal Boudette, "Tesla shines during the pandemic as other automakers struggle," *New York Times*, July 2, 2020.

Yet in terms of revenues, Japan's Toyota remains the world's largest automaker, booking $264 billion in sales in FY2023 and employing 375,235 people. Tesla's $97 billion in revenues in 2023 lagged those of other major automakers shown in Table 2, but with $15 billion in net income, it outperformed some established producers in profitability. With 140,473 employees worldwide at the end of 2023, Tesla is a significant employer. As Table 2 shows, Tesla's profitability has been achieved with significantly lower annual unit sales, even when compared to Germany's BMW, a company of similar size and output, that generates higher revenue per unit than Tesla and whose EV offerings now represent over 10 percent of its sales.[51] Even when subtracting $1.8 billion in ZEV credits Tesla collected that year (bringing its net income in line with BMW), its $7,337 net income per unit was substantially higher than BMW's $5,000 per unit on its ICE vehicles and EVs combined.

Table 2: Tesla vs. other vehicle manufacturers, sales, net income, employees, 2023

Company	Revenue, $b.	Net income, $b	Employees	Global unit sales, millions	Revenue per employee, $	Revenue per unit, $	Net income per unit, $
Toyota	264	18	375,235	8.8	703,559	30,000	2,045
Stellantis	205	20	258,275	6.2	793,728	33,065	3,226
Ford	176	4	177,000	4.4	994,350	40,000	909
GM	172	10	163,000	6.2	1,055,215	27,742	1,613
BMW	168	13	154,950	2.6	1,084,221	64,615	5,000
Tesla	97	15	140,473	1.8	690,524	53,889	8,333

Note: Stellantis, Toyota, and BMW figures adjusted by average annual 2023 currency exchange rates.
Sources: Company 10-K filings, 20-F filings, and annual reports.

Tesla also opted to make and sell charging equipment to homeowners. As noted above, Tesla's network of level 3 Superchargers has become, seemingly overnight, the U.S. rapid-charging standard. Tesla's investment in expanding the network globally played a key role in solidifying its competitiveness in Europe and China by offering not only the *availability* of rapid charging, making long-distance travel in a BEV practical, but also a typically superior rapid charging *experience*.[52]

[51] Cox Automotive, "A record 1.2 million EVs were sold in the U.S. in 2023."
[52] Sebastian Blanco, "Tesla EV chargers are best in the business, says JD Power," *Car&Driver*, July 1, 2023.

Tesla's product roadmap has generally been laid out publicly. The company takes pre-orders on planned EVs well in advance of their release—generating an important source of "earnest" cash and valuable data on product demand. In 2023, Tesla began low-volume production and sale of its Cybertruck, for which it booked about two million pre-orders (its most preorders ever), entering the high-profit pickup truck segment in the United States. Tesla also began pilot production and sale of electric semis for commercial trucking markets in 2022, in partnership with Pepsi and Martin Brower.

The company claims it will begin production of the Model 2—a BEV selling for approximately $25,000—in 2025. With average new vehicle prices in the United States set to about $48,000, and used car prices averaging about $27,000, the arrival of the Model 2 at the claimed price would place a BEV within easier reach of more consumers in the United States and abroad, particularly given available subsidies.[53]

Tesla has also been investing in the development of self-driving vehicles since around 2014. The company envisions development and integration of level 5 "autonomous" self-driving capabilities into its vehicles using artificial intelligence that greatly enhances the safety and convenience of its EVs. If successful, Tesla would enable its customers to monetize their vehicles for driverless "robotaxi" services.

In view of the emergence of China as a major producer and consumer of EVs as well as the existence of significant potential, and actual, incumbent competitors, Tesla's success as an EV manufacturer was, and is, anything but inevitable. Tesla almost went bankrupt in 2008, as it sought to move its Roadster from prototype to production, and again in 2013, as the company struggled to transform preorders for its new Model S into completed sales. In 2008, it was saved by 11th-hour financing, and in 2013, Musk struck a handshake deal to sell Tesla to Google—provided that he would remain CEO for eight years (with Tesla subsequently escaping its predicament via an "all hands on deck" sales push instead).[54] In 2016, Tesla entered "production hell" as it sought to fulfill hundreds of thousands of Model 3 pre-orders, during which time the company once more was threatened with bankruptcy as it burned cash faster than it could solve manufacturing problems.

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[53] Mathilde Carlier, "New vehicle average selling price in the United States from 2016 to 2022,"*Statista*, June 7, 2023.

[54] Ashlee Vance, *Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future*, Harper Collins, 2015, pp. 209-210, 305-306.

Hence, Tesla's ability to find and exploit sources of committed finance has been critical to its ability to advance its innovation strategy. For that Tesla has leveraged Musk's personal individual wealth with finance from venture capitalists and taxpayers as it developed products and scaled manufacturing. Tesla generated annual net losses for 16 years after its founding, posting a cumulative deficit of over $6.8 billion between 2007 and 2018. Long before it was a stock-market darling, and despite posting profits over the course of a few quarters along the way, Tesla stood out as one of the most shorted stocks in U.S. history as hedge funds spent $13 billion betting that Tesla would fail.[55]

Yet Tesla (thus far) has succeeded, and in the process has provided the EV transition with its most transformational growth. Tesla has been anything but a stealth company. Its growth strategy and business model largely occurred in plain sight. Tesla shared its "master plan" in 2006, its "master plan part deux" in 2016, and its "battery day" projections in 2020. In 2022, Tesla showed hardware and software developments during "AI Day", and in 2023, Tesla released "master plan, part 3", wherein the company laid down a vision for a global sustainable energy future. At each step, Telsa has articulated the scale as well as scope of the opportunity presented by EVs—openly with the world and its competitors.

As the current U.S. and global leader in BEVs, Tesla's business model provides a case study in how, despite immense uncertainty, it evolved from a startup, creating an unproven product, into a going concern, mass producing high-quality EVs. In the process, co-founder and self-anointed "Technoking" Musk has also emerged as a highly visible and controversial public figure, only in part because of his status as one of the world's richest people. In analyzing the evolution of Tesla as an innovative enterprise, our concern with Musk as a personality is only insofar it affects his use, or abuse, of his position of strategic control at this company that is at the center of the EV transition in the United States and globally.

4. Musk's strategic control

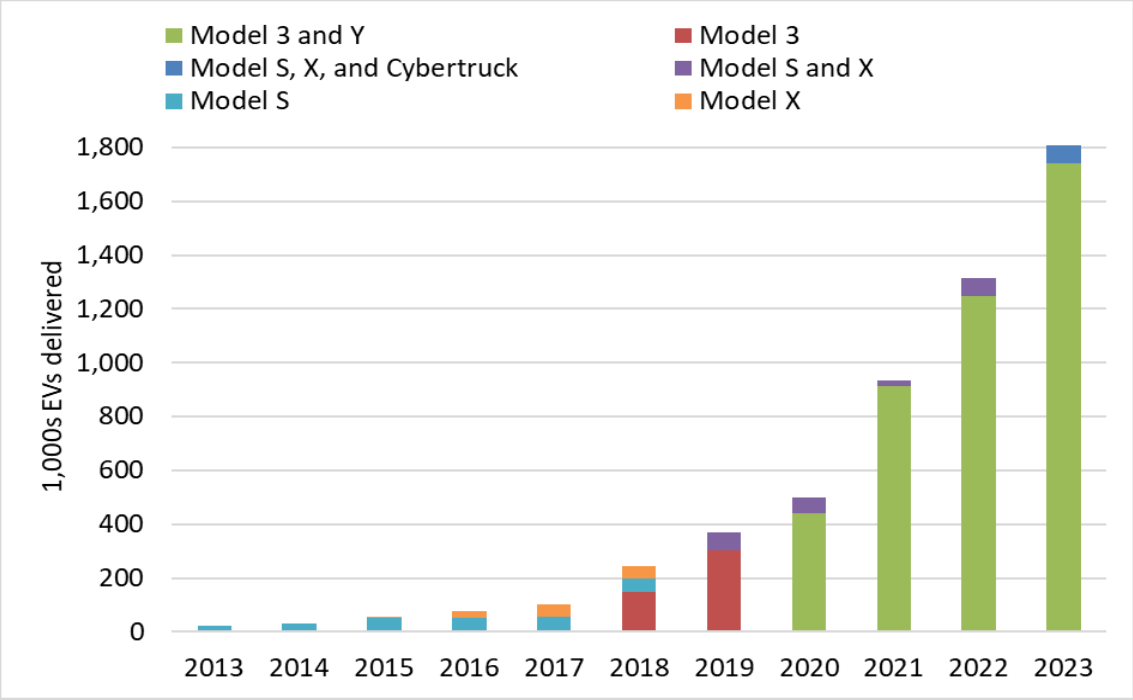
Tesla's path to profitability

Tesla's innovation strategy, as captured in Figure 12 entailed the learning progression from a high-cost, low-volume EV for a high-income relatively price-insensitive market to launching a series of lower-cost, higher-volume EV models.

[55] Sam Pierson, "Tesla: Most shorted stock ever?," *S&P Global*, August 16, 2018.

Given its relatively high price and low cumulative production volume of 2,500 units, the initial product sales of the Roadster would not be discernible on the chart. Tesla in contrast has sold almost 700,000 of its second-generation Model S and Model X BEVs. The Model 3 and Model Y, as Tesla's newest products, are also the most affordable. Since their release, Tesla has sold about five million of these two models combined.

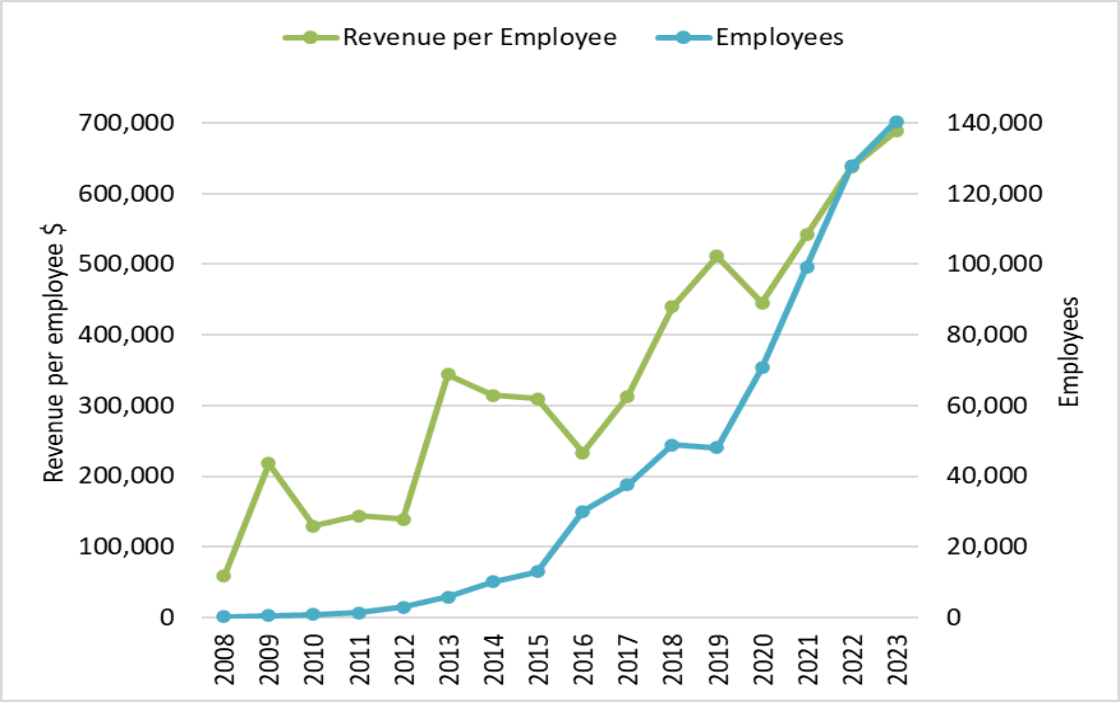
Figure 12: Tesla annual deliveries by model, 2013-2023



Note: Tesla began aggregating unit sales of the Model S/X in 2019, and Model 3/Y in 2020. Telsa delivered 2,721 vehicles in 2012, too small to see on this chart. The majority included Model S, the remainder being Roadsters. Beginning in Q4 2023, sales of Model S, Model X, and Cybertrucks were aggregated as "other models".
Source: Tesla shareholder letters, various years.

Tesla's growth is clear in its soaring employment, which increased by 47,117 from the end of 2010—the year of its IPO—to the end of 2019, and then by another 92,457 from 2019 to 2023 (Figure 13). Even as its lower-priced models became dominant in its sales, Tesla's revenues per employee skyrocketed because of increased automation and economies of scale and scope. The company that Elon Musk helped build relies on the collective and cumulative learning of many tens of thousands of people to keep high-quality, low-cost cars rolling out its factory doors. As a result, Tesla turned $6.8 billion in cumulative losses from 2007 through 2019 into $33.8 billion in profits from 2020 through 2023, including $15.0 billion in 2023.

Figure 13: Tesla's employment and revenue per employee, 2007-2023



Source: Tesla 10-K filings.

Tesla as a startup: The Roadster

As Tesla has led the EV transition, its CEO Elon Musk has become not only the richest person on earth (and as far as we know in space as well) but also the lightening rod of hubris among the global technology elite.[56] The actual founding of Tesla Motors, however, was the work of Martin Eberhard and Marc Tarpenning, who registered the company to develop electric vehicles in July 2003, naming it after Nikola Tesla, an electricity pioneer who died in poverty in 1943. Eberhard and Tarpenning then brought Musk, Jeffrey Brian (JB) Straubel and Ian Wright into the startup, all three of whom were declared co-founders of Tesla Motors in a legal settlement completed in 2009, after Musk as Tesla chairman ousted Eberhard and Tarpenning following Tesla's struggle to commercialize its first EV.

Tesla Motors was the brainchild of Eberhard, who had befriended Tarpenning at Wyse Technologies in Santa Clara, California. In 1997, during the dot.com boom,

[56] In addition to other sources cited, we draw details of the company's history and Elon Musk's career from Vance, *Elon Musk*; Edward Niedermeyer, *Ludicrous: The Unvarnished Story of Tesla Motors*, BenBella Books, 2019; Charles Morrison, *Tesla: How Elon Musk and Company Made Electric Cars Cool, and Remade the Automotive and Energy Industries*, Charles Morrison, 4.4 edition, 2021; Walter Isaacson, *Elon Musk*, Simon & Schuster, 2023.

the pair had founded a company called NuvoMedia in Mountain View, California, to produce an e-reader called the "Rocket". In 2000, they sold the company to Rupert Murdoch's Gemstar for $187 million.[57]

The Rocket eBook, which was put on the market in 1998, was a 22-ounce handheld device with an LCD backlit touch-sensitive screen that could store up to 55,000 pages of text and graphics, with a rechargeable battery that had a life of up to 40 hours in continuous use.[58] What Eberhard and Tarpenning learned from their NuvoMedia venture was that in the late 1990s a revolution in battery technology, known as the rechargeable lithium-ion "rocking chair" battery, was underway.[59] Tarpenning called the incremental improvements in Li-ion battery chemistry the "slow Moore's Law" of battery technology; he believed that Li-ion batteries that had improved performance at a rate of around seven percent each year would double in performance each decade or so.[60] Tarpenning was basically correct—the energy density of Li-ion batteries doubled between 1991 and 2008, granting them increased performance per unit weight.[61] More energy yielded from less weight meant lighter, smaller consumer electronic devices (like e-readers). It also meant that EVs could weigh less and travel farther than ever before.[62]

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[57] Fred Lambert, "Tesla's original team, where are they now?" *Electrek*, May 16, 2015; Michael Shnayerson, "Quiet Thunder," *Vanity Fair*, May 2007.

[58] Gemstar International Group, "Gemstar acquires NuvoMedia, Inc. and SoftBook Press, Inc.," *Information Today*, March 2000.

[59] The "rocking chair" Li-ion battery features two insertion electrodes, the anode (negative) and cathode (positive). Ions move between the electrodes, with electrons either collecting into the battery or discharging into an electrical load.

[60] See Bruno Scarosati, "History of Lithium Batteries," *Solid State Electrochemistry*, 15, 7-8, 2011: 1623-1630. Scarosati suggests that lithium-sulfur and lithium-air batteries could produce enormous performance gains over current lithium-ion battery technology, boosting energy density from 150 watt-hours/kg to 2,600 or 11,400 watt-hours/kg. This innovation would enable battery packs weighing a fraction of today's packs while providing the same amount of range. For example, a 30-kWh battery pack (offering approximately 100 miles of range), weighing about 440 lbs. could shrink to just 25.4 lbs. (Li-S), or 5.8 lbs. (Li-O2). Note that 1 gallon of gasoline provides the equivalent of about 33.4 kWhs and weighs about 6 lbs. (but because of the relative inefficiency of ICEs, only about one third of that potential energy is converted to forward locomotion, the rest wasted).

[61] Anon., "In search of the perfect battery," *Economist*, March 8, 2008.

[62] While there are some who lament that batteries are less energy "dense" than, for example, gasoline, it is important to remember that having more energy available is not useful if it cannot be extracted and utilized efficiently. In the context of vehicles, an important reason to seek greater density from batteries is to reduce total vehicle weight, which benefits performance as well as cost.

Around the same time that innovative rechargeable Li-ion batteries were becoming more widely available, AC Propulsion, a San Dimas, California company founded in 1992, was developing innovative high-performance electric powertrains and retrofitting them into ordinary ICE vehicles.[63] At AC Propulsion, EV experts with engineering experience were brought together from GM, AeroVironment, and Hughes (a GM subsidiary). The founders Alan Cocconi and Wally Rippel (and early employee Paul Carosa), all electrical engineers, developed state of the art experience with EVs in part by designing and developing GM's successful Sunraycer EV in the late 1980s, a solar-powered EV that later provided an argument for their development of GM's infamous EV1, released in 1996 to satisfy new "Zero Emission Vehicle" (ZEV) requirements in California, the largest U.S. auto market. Offered in limited quantities to customers on a lease-only basis, GM recalled and (literally) crushed the last EV1s in 2003.[64]

GM was not the only auto company experimenting with EVs in the 1990s in response to the California mandate. Since 1967, the California Air Resources Board (CARB)[65] had been unique in its ability to set state emissions standards independently of federal standards, which did not appear until the 1970 Clean Air Act. In 1990, California set a "zero emission mandate", requiring that two percent of all new vehicles sold be zero-emission vehicles (ZEV) by 1998, rising to five percent by 2001, and ten percent by 2003. California's rules were eventually weakened by auto industry pushback,[66] but not before major automakers developed some hybrid and battery EVs. The commercially successful Toyota Prius, released in 1997, and the Honda Insight, released in 1999, both gasoline hybrids, arguably would not exist but for California's policies. A longer-lasting impact was the establishment of market mechanisms for the awarding and sale of ZEV "credits", which, with full credits for BEVs and partial credits for hybrids, permitted automakers to purchase compliance with California's regulations from other automakers that produced and sold qualifying vehicles. Today, almost every U.S. state offers incentives for EVs, and

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[63] Tom Gage, "Who Killed the Electric Car?", Tom Gage, CEO of AC Propulsion, provides customer testimonial for SAP Business By Design," *Mergers and Acquisitions: The Dealmaker's Journal*, May 1, 2011; Forbes Black, "AC Propulsion – The quiet revolutionaries," *Evworld*, October 27, 2009; Kevin Wilson, "The 120-year history of the electric car, in pictures," *Popular Mechanics*, December 16, 2015; Jay Yarrow, "Tesla team brawls over who deserves credit for the company," *Business Insider*, June 29, 2009.

[64] The regulations came from the amended 1990 Clean Air Act and the 1992 Energy Policy Act.

[65] See California Air Resources Board, "History," CARB (accessed August 18, 2024).

[66] See California Air Resources Board, "Zero-emission vehicle program," CARB (accessed August 18, 2024).

twelve states plus the District of Columbia have adopted California's ZEV policies, expanding the size and value of the ZEV credit "market" to manufacturers.[67]

In 1997, AC Propulsion created the electric tzero, leveraging a "Sportech" chassis developed by Dave Pionetek, a Ford engineer,[68] who was perhaps inspired by John Fagan, a professor of electrical engineering and computer science at the University of Oklahoma, who had used AC propulsion components to build an electric version of the Sportech at about the same time.[69] Powered by 28 Johnson Controls lead-acid Optima Yellow Top batteries weighing in at 1,250 lbs., the tzero could do the 0-60 in under five seconds and provide approximately 100 miles of range.

Fellow engineer and race-car driver Tom Gage joined AC Propulsion in 1996, and in November 2002 Gage met Eberhard, who was known to be interested in EVs. Impressed by his test drive of the tzero, Eberhard invested $100,000 in the company, which was cash-strapped at the time as its EV conversion business was suffering from revisions to the California ZEV mandate. Eberhard wanted AC Propulsion to develop a Li-ion battery powered version of the tzero, which was completed around August 2003.[70] Upgraded with new "off the shelf" size 16850 cylindrical Li-ion batteries, assembled into one hundred 68-cell battery packs, the Li-ion powered tzero was 700 lbs. lighter than the lead-acid version and could travel 300 miles fully charged.[71] The car accelerated as quickly as a world-class sports car despite little noise and no emissions, and regenerative braking through the AC induction electric motor improved the tzero's range in stop-and-go driving. Sold on the tzero concept, Eberhard wanted to buy one. He was denied because it was "too difficult to build", requiring fabrication of custom parts.[72]

Recognizing that AC Propulsion would not mass produce an electric sports car, Eberhard and Tarpenning incorporated Tesla on July 1, 2003, renting an office in Menlo Park, seven minutes from Stanford, hiring an engineer, and neighbor, Ian

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[67] Austin Igleheart, "State Policies Promoting Hybrid and Electric Vehicles," *National Conference of State Legislatures*, August 23, 2023.

[68] Don Sherman, "Tesla's towering electric oak tree grew from this little-known acorn," *Hagerty*, March 9, 2021.

[69] Mark Vaughn, "Tesla's little-known prehistory," *Autoweek*, March 1, 2021.

[70] Black, "AC Propulsion – The quiet revolutionaries."; Chris Dixon, "Driving; Lots of zoom with batteries," *New York Times*, September 19, 2003; Shnayerson, "Quiet Thunder".

[71] Dixon, "Driving; Lots of zoom". The batteries allowed the tzero to shed 700lbs. while increasing range by about a factor of three. In addition, the batteries allowed for rapid 220 volt charging—an important feature for modern EVs.

[72] Tom Gage, as quoted in Black, "AC Propulsion – The quiet revolutionaries"; Morrison, *Tesla.*

Wright, as one of the first employees. They used the lithium-ion powered tzero during 2004 to demonstrate Tesla's vision for a high-performance EV to potential investors.[73] Driving around Palo Alto as part of their market research, the pair observed Toyota Prius' sharing driveways with more expensive vehicles. Eberhard and Tarpenning decided that a lightweight, long-range sports car would be most likely to demonstrate the viability of an EV, while attracting high-income buyers.

The entrepreneurs believed that an EV startup could succeed because decades of globalization had transformed (or rather reduced) major automakers to powertrain producers that outsourced the majority of other components, and sometimes even assembly of their vehicles, to third parties.[74] Eberhard recognized that battery technology was sufficient for automotive applications with little compromise, and, as he put it, "the international business climate makes it now possible to build a 'fab-less' car company—a car company without a factory."[75] For the purpose of establishing and running a startup with a single product, Eberhard was not wrong.

With access to the same suppliers and assemblers, a startup such as Tesla Motors could focus on developing battery packs comprised of modern Li-ion batteries into an innovative EV powertrain. The founders assumed that Tesla's organizational learning from investing in its first product would improve efforts made for subsequent, more affordable, and less niche EVs. Tesla Motors' accumulated experience would place the company at a competitive advantage over incumbent ICE manufacturers, historically unmotivated to seriously invest in commercial EVs (as the 1990s and early 2000s had made clear, given the experience in California), and allow it to grow into a major EV manufacturer. As it turned out, Tesla went on to operate for 13 years after its founding with virtually no direct competition.[76] They needed funding to get the business going, and they found someone who had it: Elon Musk.

Like Eberhard and Tarpenning, Musk made his mark in the business world during the dot.com boom of the 1990s. He had earned a bachelor's degree from the University of Pennsylvania in physics and economics but dropped plans to do a PhD on materials and physics at Stanford to become an entrepreneur. Musk became a

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[73] Matt Pressman, "From Tzero to Model S; How AC Propulsion was a catalyst for Tesla Motors," *Evannex*, February 6, 2016.

[74] Drake Baer, "The making of Tesla: Invention, betrayal, and the birth of the Roadster," *Business Insider*, November 11, 2014.

[75] Niedermeyer, *Ludicrous*, pp. 35-36.

[76] Nissan's all-electric Leaf, for example, was released in 2010, two years ahead of Tesla's Model S which, in any case, was in a different market segment.

millionaire as a founder or co-founder of several companies, starting with Zip2[77] in 1995, which was funded partially by his father's savings and, in 1996, with a $3-million infusion from venture capital firm Mohr Davidow Ventures. Zip2 was purchased by Compaq in 1999 for $307 million, yielding the 27-year-old Musk $22 million.[78] That year, he founded X.com, an online payment company. In 2000, X.com merged with Cofinity, maker of an online digital payment service called PayPal, which in 2001 became the company's new name. PayPal was acquired by eBay in 2002 for $1.5 billion, with Musk getting $165 million from his 11.7 percent share. Musk used a portion of those funds to found SpaceX in 2002, with a vision of eventually sending people to Mars.

As Musk described it 13 years later, his decision to invest some of his wealth into production of a low-volume sports car was not just based on market insight. As he explained:

> it was all I could afford to do with what I made from PayPal. I thought our chances of success were so low that I didn't want to risk anyone's funds in the beginning but my own. The list of successful car company startups is short. As of 2016, the number of American car companies that haven't gone bankrupt is a grand total of two: Ford and Tesla. Starting a car company is idiotic and an electric car company is idiocy squared.[79]

A few months after Eberhard and Tarpenning had founded Tesla Motors in July 2003, Musk was introduced to AC Propulsion and the tzero EV by JB Straubel, a Stanford graduate who had met Musk in an attempt to seek funding for a Li-ion battery-powered EV. Straubel had friends at AC Propulsion and was aware of their success with EVs and the tzero. Cocconi brought the tzero to Musk's SpaceX campus for a test drive, which impressed Musk so much he asked to buy it. When Cocconi declined, Musk offered $250,000 for Cocconi to convert his Porsche to electric drive. Cocconi refused, recommending to Musk that he contact Eberhard.

What Musk and the Tesla founders had in common, therefore, when they met in February 2004, was mutual appreciation for the concept of a Li-ion powered EV. Each had seen the potential in EV Propulsion's powertrain technologies, but each also envisioned investing in an electric sports car, not an AC Propulsion "eBox"—a

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[77] Pat Bauer, "Zip2," *Britannica Money*, August 17, 2024; Isaacson, *Elon Musk*, p. 66.
[78] Mark Mann, "The story of Elon Musk's first company," *SiteBuilderReport*, June 16, 2022.
[79] Elon Musk, "Master Plan Part Deux," *Tesla*, July 20, 2016.

converted Scion xB that AC Propulsion was interested in attempting to mass produce. Notably, the eBox would solve compliance problems that arose from using a "kit car" as a starting chassis.[80] But Eberhard viewed such a vehicle as a "punishment car"—an environmentally friendly car with little, if any, enthusiast appeal.[81] Or, put differently, it was the sort of vehicle that automakers usually created when they promised an "environmentally friendly" design.

Musk shared Eberhard's vision of what an EV should be, and in April 2004 agreed to become Tesla Motor's largest investor, providing $6.35 million (85 percent) of the company's $7.5 million[82] Series A financing round. The remaining funds came from contributions of the founders and Compass Technology Partners, a Menlo Park (i.e., local to Tesla at the time) venture capital firm. In exchange for his investment, Musk got the two founders to agree that he would be Tesla's chairman of the board, with the "final say over all decisions".[83] Musk picked Eberhard to serve as CEO and Tarpenning as CFO.

Tesla used the funds to begin development of its "Roadster"—a two-seat sports car not unlike the tzero. Tesla licensed drivetrain technology from AC Propulsion and connected with U.K.-based Lotus for its "Elise" sportscar chassis as well as development and manufacturing support. Straubel, who had been at work on a Li-ion battery pack with a $10,000 investment by Musk, was hired by Tesla in May 2004, with a salary of $95,000, to begin working on integration of a Li-ion battery pack into the powertrain.[84] Straubel attracted other key engineers whom he knew from Stanford, including Gene Berdichevsky and David Lyons, to Tesla to work on the Roadster. By the end of January 2005, Tesla's 18-member team in Menlo Park had created a working Roadster prototype.

Pleased with the progress, Musk put up $9 million of Tesla's $13 million Series B funding round in February 2005 to finance additional prototypes. Another investor was Value Equity Partners, which contributed $2 million (with unknown contributions by others). Value Equity Partners was founded in 1995 by Musk's friend, Antonio Gracias, who subsequently joined the Tesla board in 2007.

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80 Gage, "Who Killed the Electric Car?".
81 Morrison, *Tesla*, p. 80.
82 Kah Seng Tay, "How much equity did Elon Musk get from investing In Tesla's Series A?" *Forbes*, Dec 29, 2014.
83 Morrison, *Tesla*, p. 87.
84 Straubel eventually accumulated significant shares of Tesla stock, worth over $1 billion.

Tesla marketed the Roadster directly to wealthy and famous individuals, showing off its attractive styling, offering short test drives, and promising 250 miles of range for about $90,000 (the Roadster later sold for $109,000). Tesla used the publicity to help complete a $40 million Series C financing round in May 2006—with Musk putting up another $12 million—which attracted 31 new venture capitalists or wealthy individuals, such as Google founders Sergey Brin and Larry Page, with Capricorn Management, Compass Technology, Google, DBL Partners, VantagePoint Venture Partners, Draper Fisher Jurvetson, and JP Morgan joining in. Engineering prototypes attracted early high-profile customers willing to put down deposits.

The Roadster continued to develop, with Tesla making substantial modifications to the Lotus chassis and working on the car's battery safety management technologies and electric motors.[85] In July 2006, the Roadster was officially unveiled, and high-profile showings were used to attract customers and media attention. The company's first "Master Plan", published by Elon Musk on the company's website on August 2, 2006, publicly revealed Tesla's innovation strategy to produce a low-volume, high-cost vehicle, sold to high-income customers to provide financial and learning foundations for development and production of increasingly low-cost, high-volume EVs down the line.[86] In August 2006, two years before Tesla began deliveries of its Roadster, the "master plan"[87] boiled down to four points:

1. Build 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 above, also provide zero emission electric power generation options

Typically, it is far more likely that a sports car would be subject to a gas-guzzler tax rather than provide a model of energy efficiency. In a paper released on October 6, 2006, Eberhard and Tarpenning labeled the combination of high performance with high efficiency in an EV their "disruptive technology", describing the superior "well

[85] When and why Tesla ceased licensing AC Propulsion's motor technologies is disputed by Tesla's founders and AC Propulsion's Tom Gage. The former claim to have moved beyond AC Propulsion's motors "a year before production", or prior to development of engineering and validation samples. Gage's account is that Tesla paid fees on approximately 500 vehicles, and then abruptly stopped.

[86] Elon Musk, "The Secret Tesla Motors Master Plan (just between you and me)," *Tesla Motors*, August 2, 2006.

[87] Ibid.

to wheel" efficiency of Tesla's first product.[88] The Roadster was designed from the outset to appeal to high-income car enthusiasts. With rapid acceleration that rivaled or bested world-class sports cars, zero emissions, and a relatively long range of about 250 miles, the Roadster demonstrated to celebrity buyers and skeptics that modern EVs could be anything but "punishment cars"—small, ugly, slow and unappealing, even if environmentally "friendly" vehicles (like the Priuses that might be found parked next to Porches in Palo Alto).[89] As Eberhard and Tarpenning wrote:

> It is now possible to build an exceedingly quick lithium-ion powered electric sports car that looks good, handles well, and is a joy to drive, at a lower price than most high-performance sports cars. And yet, this car will be the most fuel-efficient and least polluting car on the road. You can have it all.

Series C funding supported development of Roadster validation vehicles in 2007, and in May 2007 Series D funding raised an additional $45 million. Musk put up $10 million, with 28 other investors contributing the rest, including returning investors Capricorn Management, Compass Technology, Google, DBL Partners, VantagePoint Venture Partners, Draper Fisher Jurvetson, and JP Morgan. Ira Ephrenis, who founded DBL partners in 2003, joined Tesla's board in 2007 (on which he remains in 2024). The first 100 Roadster buyers put down $100,000 deposits on their "signature 100" cars, adding $10 million to Tesla's investable funds.[90] By June 2007, 560[91] people had plunked down $9,900 in cash to reserve a Roadster, contributing an additional $4.5 million toward Roadster production, with Tesla planning to produce 800 in 2008.

As Tesla Motors struggled to deliver on its Roadster, Musk became increasingly involved in day-to-day operations, clashing with Eberhard over details of the car, cost overruns, and delays caused by, for example, technical problems with the Roadster's original 2-speed transmission or Musk's own micromanagement of the

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[88] Martin Eberhard and Marc Tarpenning, "The 21st Century Electric Car," *Tesla press release*, October 9, 2006. Following a 2009 lawsuit after Eberhard's ousting as CEO and board member of Telsa, "official" Tesla founders now also include Elon Musk, JB Straubel, and Ian Wright. Martin LaMonica, "Tesla Motors founders: Now there are five," *CNET*, September 21, 2009.

[89] Joshua Davis, "Batteries included," *Wired*, August 1, 2006.

[90] Morrison, *Tesla*, p. 111; "Tesla Roadster 'Signature One Hundred' series sells out," *Tesla press release*, April 20, 2010; According to Niedermeyer, *Ludicrous*, p.45, the signature series sold out in just two weeks.

[91] Tesla, "Tesla Motors surpasses 500th 2008 Roadster reservation," *Tesla press release*, April 20, 2010.

vehicle's design features and development priorities. With just 2,500 units ultimately produced, the Roadster was sure to be a money loser. Tesla's learning experience organizing the Roadster's mass production taught the company's executives that, in planning future models, they should bring more component production in-house.[92]

Meanwhile, Musk, set on being viewed as both Tesla's founder and visionary,[93] prevailed upon the board to oust Eberhard as CEO. Eberhard was demoted to president of technology in August 2007, after Tesla's VC investor Valor Equity (through Tesla board member Antonio Gracias) brought in Tim Watkins, a robotics and electrical engineer, to study Tesla's growing cost overruns. Watkins discovered that Tesla's Roadster, selling for $90,000, might cost $200,000 to produce—far worse than previous estimates of $60,000 to 100,000.[94]

Tesla's second, interim CEO was a Tesla investor named Michael Marks, ex-CEO of contract manufacturer Flextronics, charged with overcoming Tesla's production problems and completing the rollout of the Roadster. Marks had appealed to Musk in part for his success in turning Flextronics into a leading company through vertical integration.[95] His strategy for Tesla, however, was to partner with an automaker to produce the Roadster, rather than try to bring production in-house. Marks came up with a 10-point, 100-day plan to fix Tesla's production issues. While Marks had experience running global supply chains and largely succeeded in helping get Tesla back on track, his preference for repairing Tesla's immediate issues and packaging "Tesla as an asset that could be sold to a larger car company" clashed with Musk's vision of seeing Tesla grow into a vertically integrated, and independent, automaker.[96]

Musk replaced Marks with Ze'ev Drori on December 3, 2007, after Marks completed his 100-day plan, and about the same time Eberhard was removed from Tesla's board, with CFO Tarpenning leaving the company with him. Not Musk's first choice, Drori came to be "seen as an executor of Musk's wishes",[97] with Musk "very much the power behind the throne at this point."[98] Drori fired 10 percent of Tesla's workforce—many of them employees whom Eberhard had hired. After his departure, Eberhard sued Tesla for slander and breach of contract, settling in

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92 See, e.g., George Reichon, "Tesla's secret second floor," *Wired*, October 18, 207l

93 Details are discussed in Issacson, *Elon Musk,* chapter 21.

94 Vance, *Elon Musk,* pp. 168-173; Issacson, *Elon Musk,* pp. 159-161; Morrison, *Tesla,* p. 132.

95 Isaacson, *Elon Musk,* p. 165.

96 Vance, *Elon Musk,* p. 174.

97 Ibid.

98 Morrison, *Tesla,* p. 136.

September 2009 for terms that included, as noted above, declaring Musk, Straubel, and Wright as co-founders of Tesla.

In March 2008, under Drori, the Roadster went into production. Tesla built the Roadster as a global product, taking advantage of global supply chains in the existing auto industry.[99] Final assembly of the "outsourced" EV was carried out by Lotus in Hethel, U.K., for international markets, or, in the United States, at San Carlos, California, where Tesla employees integrated the electric powertrain into the chassis. However, the modifications required to develop the Roadster as an "adapted" ICE chassis were so extensive that Musk called it "an incredibly dumb idea" in retrospect.[100] Tesla estimated that the Roadster ended up sharing just seven percent of its parts with the Lotus Elise, and it had to develop its licensed AC Propulsion technology further to improve performance and permit mass production.[101]

Production of the Roadster commenced in March 2008, and in May 2008, Tesla opened its first retail store[102] in Los Angeles, California. In July 2008, Musk replaced Tarpenning as CFO with Deepak Ahuja, who would hold the position until 2015 (returning in 2017 to replace Jason Wheeler, only to leave once more in 2019). By October 2008, it was clear that Tesla's cash burn threatened bankruptcy. On October 17, 2008, with about $27.5 million invested in Tesla and the U.S. economy beginning its slide into the Great Recession, Musk removed Drori and installed himself as CEO. He then fired 87 of Tesla's 386 employees.[103] At that point, Tesla had taken in 1,200 deposits for Roadsters (about $21 million) but had produced only 50, far behind its 800-unit target.[104]

In late December 2008, despite raising an additional $40.2 million in convertible debt and collecting millions in deposits from Roadster buyers, Tesla was out of cash. The company was saved by Musk's fundraising efforts, who leveraged personal funds and those of friends and family, as part of a $40 million funding round comprised of convertible debt provided to 42 investors. Musk's decision to re-characterize the funding round as debt versus equity protected his continued exercise of strategic control by preventing Alan Salzman of VantagePoint from driving Tesla

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99 Ibid., chapter 5.
100 Ibid., p. 160.
101 Darryl Siry, "Mythbusters part 2: The Tesla Roadster is not a converted Lotus Elise," *Tesla Motors*, March 3, 2008; Bob Sorokanich, "Elon Musk admits to shareholders that the Tesla Roadster was a disaster," *Road & Track*, June 1, 2016.
102 Tim O'Leary, "Tesla Store Los Angeles," *Tesla press release*, May 14, 2008.
103 Morrison, *Tesla*, p. 141.
104 Vance, *Elon Musk*, p. 205.

into bankruptcy by refusing to commit additional cash.[105] Given the company's struggle to scale production, Salzman believed that Tesla should transform itself into a battery-pack producer by partnering with a major auto company. Key to gaining the buy-in of Tesla's other backers, Musk put up an additional $12 million into Tesla during its 11th hour funding round, bringing his total investment to $49 million. With this funding (and given similar dire straits at SpaceX), Musk was viewed as someone willing to put his money where his mouth was.

Key to Tesla's survival (while at the same time showing Salzman that he was not being totally ignored), in January 2009 Tesla landed a $70-million contract from Daimler to supply battery packs and chargers for its SmartfortTwo EV. During Tesla's May 2009 Series E financing round, Daimler invested $50 million more into Tesla, for close to ten percent of the company's outstanding shares, and placed Daimler executive Herbert Kohler on the company's board. The investors who had participated in Tesla's February and December 2008 bridge financing rounds converted their debt into Series E stock, bringing the total raised from the Series E round to $136 million. In August 2009, after showing a small profit of $1 million, Tesla launched a Series F funding round, raising $82.4 million from Al Wahada Capital Investment and Blackstar Investco, the investment arm of Daimler. All in all, Tesla produced 2,500 Roadsters, with 2,450 units having been delivered at the end of 2012.[106]

The second generation: Model S and Model X

Tesla's next EV, the Model S, was unofficially revealed in 2007 when Tesla approached Henrik Fisker, an automotive industry veteran of BMW, Aston Martin, and Ford, living in Southern California, to lead its design. Despite a resume that included work on attractive vehicles like the BMW Z8 and Aston Martin DB9, Fisker produced unattractive "egg shaped" designs for Tesla, and left after just nine months—moving on to found competing EV maker Fisker.[107] Next up was another auto industry veteran Franz von Holzhausen, whose resume included work for Volkswagen (Beetle), GM (Pontiac Solstice and Saturn Sky), and Mazda (Kabura). Holzhausen designed the Model S in-house at an office located close to Musk at SpaceX in Los Angeles.

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[105] Ibid., pp. 207-210.
[106] Tesla 2014 10-K, p. 4.
[107] Issacson, *Elon Musk*, pp. 196-197.

On March 26, 2009, with Roadster production underway (and pricing for the 2009 model year raised to $109,000, from about $92,000), Tesla made its official unveiling of the Model S, calling it the "world's first mass-produced, highway-capable EV."[108] In December of that year, Musk, as CEO, was given a grant of 100.7 million (split-adjusted) stock options, equal to eight percent of Tesla's outstanding shares. Half of the options vested according to a three-year schedule, with Musk claiming the remaining options as Tesla met Model S development milestones, culminating in the manufacture of at least 10,000 units.[109] Hence, to get all the stock options in this package, Musk had to begin transforming Tesla into a mass producer of EVs.

While the Roadster was a global product with final assembly partially outsourced to Lotus,[110] the Model S, in stark contrast, was designed from the ground-up as a "clean sheet" EV to be produced in-house by Tesla, with a host of innovations and a target retail price of $57,400 before new federal tax credits applied (which would reduce the price to $49,900). In January 2010, Tesla received a $465-million loan from the Department of Energy, under the 2009 American Recovery and Reinvestment Act (ARRA), part of the Obama administration's response to the Great Recession.[111] New government tax credits of up to $7,500, depending on battery pack size,[112] were available to purchasers of plug-in hybrid or battery electric vehicles, lowering their total purchase price.

The tax credits, which were in effect from 2010 to 2022, provided $1.5 billion in indirect subsidies for the first 200,000 qualifying EV units that a car manufacturer sold. For Tesla, the Roadster, Model S, Model X, and Model 3 all qualified. Additional tax credits based upon the number of deliveries of EVs over a five-quarter phase-out period then applied (for one quarter after reaching the 200,000-unit limit, the full $7,500 tax credit still applied, with the benefit cut to $3,750 for the next two

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[108] Tesla, "Tesla unveils world's first mass-produced, highway-capable EV," *Tesla press release*, March 26, 2009.

[109] The shares had an adjusted exercise price of $0.442/share and vested in four tranches.

[110] Tesla did final assembly for its North American customers at its Menlo Park facility.

[111] Tesla, "Tesla gets loan approval from US Department of Energy," *Tesla press release*, April 20, 2010; Brian Eckhouse, "Tesla wouldn't be Tesla without stimulus spending," *Bloomberg*, June 9, 2020.

[112] To claim the maximum credit, the battery pack had to be 16 kWh or greater. The Chevy Volt, launched by GM in 2010 in response to Toyota's successful Prius hybrid and Tesla's successful Roadster, had a 16-kWh battery pack that provided about 40 miles of electric range before an onboard gas engine turned on to run the powertrain.

quarters and $1,875 for the final two quarters).[113] Given Tesla's surge in sales during its phase-out period, we estimate that Tesla received an additional $1.7 billion in indirect subsidies.

Tesla also once more crowdsourced funding, offering a limited "signature edition" of the Model S—a long-range, high-performance variant to those willing to put down $40,000 down on the first 2,000 units (collecting $80 million). By the end of 2012, as the Model S entered production, another 15,000 individuals had paid $5,000 to reserve non-signature units, raising an additional $75 million.[114]

Tesla could tap this purchase-deposit credit only after incurring expenses, however, requiring it to have access to other sources of cash. To aid in its search for this funding, Diarmuid O'Connell was hired by Tesla in 2006 as vice-president of business development. With experience in management consulting and as chief of staff to Bush security adviser Lincoln Bloomfield during the Iraq and Afghanistan wars, O'Connell was attracted to Tesla's mission to transition the world from oil to EV propulsion. O'Connell was hired by Tesla to seek out government support for the company and played a role in landing the company's crucial Department of Energy loan.

Tesla's success drumming up demand for the Model S reflected the vehicle's innovative features and performance, which matched, if not exceeded, those of similarly priced ICE vehicles. Tesla's reservations served another purpose as well, providing the company with information about where it would locate Supercharger stations.[115] To overcome a prime EV adoption hurdle, Tesla began constructing a coast-to-coast Supercharger network for its Model S customers, offering, initially, free (and eventually solar-powered) rapid charging.[116] The Supercharger network was a solution to a key barrier to broader EV adoption—the lack of rapid chargers in the United States.

In 2013, Tesla began providing a resale guarantee to Model S buyers, mitigating their concerns of rapid depreciation. Rejecting the practice of the rest of the U.S.

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[113] IRS, "Manufacturers and models for new qualified clean vehicles purchased in 2022 and before," *Internal Revenue Service* (accessed August 19, 2024).

[114] Tesla 2012 10-K, p. 4.

[115] For example, stating in its Q1 2018 update: "We continue to build Supercharger stations in locations with the highest demand and the most reservation holders. As a result, we are able to open new stations in specific locations even before fleet expansion takes place."

[116] Tesla, "Tesla Motors launches revolutionary supercharger enabling convenient long distance driving ," *Tesla press release*, September 24, 2012.

automobile industry, Tesla also sold and serviced its Model S directly rather than through franchise dealerships. Tesla has continuously lobbied state governments for preferential treatment of its direct sales model.[117]

With the spotlight shining on clean technology more generally, Tesla's fortunes were improving. As more Roadsters were built and delivered Tesla's revenue grew from just $15 million in 2008 to $112 million in 2009, with employment more than doubling to 514. As Tesla delivered more EVs, it banked more ZEV credits—$8 million in 2009, up from $3 million in 2008. With plans to produce the Model S in 2011 (Tesla began Model S deliveries in June 2012), Tesla filed for its IPO in January 2010, revealing at that time that it already had 2,000 reservations for the Model S.[118] At the same time, Tesla announced it was partnering with Panasonic to develop "next generation" Li-ion battery cells, based upon Panasonic's innovative nickel-based Li-ion technology. In May of that year, Tesla entered into a contract worth about $70 million with Toyota to develop an electric powertrain for Toyota's RAV4.[119]

With validation of the company's capabilities to generate an exciting EV in the form of the Roadster, partnerships with major auto and battery makers, and customer and government-backed financing, Tesla completed its IPO in June 2010. After excluding cash provided to existing shareholders, underwriters, and expenses, Tesla brought in $184.5 million to support capital expenditures for Model S development and manufacturing.[120] In separate private stock placements carried out during and right after the IPO, Tesla collected an additional $50 million from Toyota and $30 million from Panasonic. To further pad its cash holdings, in June 2011 and October 2012, Tesla completed secondary stock offerings to net an additional $231.5 million and $221.5 million.[121]

Prior to its secondary offerings, and despite having raised over $700 million from its IPO, strategic partners, and the Department of Energy loan, Tesla was still well short of the cash needed to build a manufacturing plant for the Model S, particularly since in 2009 it posted a net loss of $56 million on $112 million in revenues. Hence the

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[117] Fred Lambert, "Tesla launches new multi-state effort against direct sales ban," *Electrek*, January 28, 2019; Peter Stenquist, "Why you might buy your next car online," *New York Times*, June 21, 2022.

[118] Poornima Gupta, "Electric carmaker Tesla files for IPO," *Reuters*, January 29, 2010.

[119] Tesla 2010 10-K, p. 19.

[120] Musk was the largest seller during the IPO, selling 908,958 of the 1.4 million shares sold into the IPO, gaining Tesla's venture backers, including Musk, gaining about $15.5 million.

[121] Tesla 2011 10-K, p. 98; Tesla 2012 10-K, p. 89

company's luck when, in October 2010, it acquired the 5.5-million square foot New United Motor Manufacturing Inc. (NUMMI) plant in Fremont, California from Toyota for just $42 million.[122] Tesla purchased about $17 million in manufacturing equipment and received a State of California sales-tax abatement worth about $20 million. Opened in 1962 by GM, the plant at its peak had produced over 400,000 vehicles annually under the joint-venture management of GM and Toyota, which began in 1984 and ended when GM declared bankruptcy in 2009.[123]

Andrew Baglino was placed in charge of developing the Model S battery pack, with Peter Rawlinson serving as chief engineer. Henry Brice, a former chief engineer for Ford, was also brought in to lead Model S development. At the time, Musk referred to his new hires as among "the best and the brightest of the automotive industry".[124]

Baglino, a Stanford graduate, joined Tesla in 2006 to work on the Roadster, rising to senior vice-president of powertrain and energy engineering in 2019, resigning in April 2024 during a mass layoff initiated by Musk. Rawlinson, a veteran of Jaguar and Lotus, joined Tesla in 2009, helping to build the Model S engineering team before leaving in 2012.[125] Rawlinson joined Li-ion battery startup Atieva in 2013 as a board member and chief technology officer, then oversaw the company's re-brand as Lucid Motors in 2016, becoming its CEO in 2019.

Tesla benchmarked a Mercedes CLS luxury sedan and used multiple copies of it for development of the Model S, which would compete against similarly high-priced luxury ICE vehicle options. The new EV featured a "skateboard" platform that, unlike with the Roadster, took advantage of the absence of ICE components to place the battery pack low for a flat floor and better packaging and handling. Along with a five-star crash rating, the Model S's low center of gravity made it nearly impossible to roll over.

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[122] David R. Baker, "Tesla paid only $42 million for NUMMI plant," *SFGate*, May 28, 2010. Gilbert Passin, a former Toyota executive who had been general manager. Of NUMMI, joined Tesla in 2010 as its VP of manufacturing.

[123] Dana Hull, "Tesla reviving defunct auto plant," *Los Angeles Times*, September 29, 2010; Benjamin Gomes-Casseres, "What Toyota learned and GM didn't," *Harvard Business Review*, September 1, 2009.

[124] Tesla, "Tesla Motors announces senior engineering and manufacturing executives," *Tesla press release*, April 20, 2010.

[125] Niraj Chokshi and Jack Ewing, "He helped build Tesla. Now he's gunning for it," *New York Times*, November 18, 2021; Barry Ritholtz, "Transcript: Peter Rawlinson, Lucid CEO/CTO," *Ritholtz*, June 25, 2024.

The Model S came in rear- or all-wheel drive options, was slated to provide up to 300 miles of range, needed only 45 minutes to recharge, and could accelerate from 0 to 60 mph in 5.6 seconds.[126] It could do so while being quieter and at least as smooth as a top-tier luxury vehicle. The S offered seating for up to seven people, a "frunk" in the front of the vehicle and a trunk in the rear. Along with having more trunk space than a typical car, and a loading area that rivaled SUVs, Tesla claimed it cost just $5 to drive 230 miles—a fraction of the cost of an ICE vehicle.

The Model S had an innovative aluminum body, a large glass sunroof, a 17-inch touch screen in the dashboard, rapid-charging capability, and, with a wireless internet connection, "over the air" software update capability. In September 2014, Tesla began including first generation "autopilot" safety features in the Model S and its future EVs. Following its release, the Model S received a near perfect score of 99 out of 100 from *Consumer Reports*, the highest score its reviewers had ever given.[127] It also was named "2013 Motortrend Car of the Year".[128]

In anticipation of selling tens of thousands of EVs, Musk had George Blankenship, formerly of Apple, take charge of expanding Tesla's Apple-like sales and service centers in Europe (Norway) and the United States.[129] Tesla's customers could reserve and order their Model S at a Tesla store or online (whether by computer or smartphone), and customers could opt to pick up their Model S at the Fremont factory, receiving a tour,[130] or take delivery at a location of their choosing.

Despite receiving numerous positive accolades, the Model S, like the Roadster, once more threatened Tesla with bankruptcy. At the Fremont factory, Musk placed engineers in close quarters with production workers to ensure that production issues were rapidly resolved. By the end of 2012, after barely one year, Tesla had produced more Model S units (3,100) than its entire production run of Roadsters. Tesla began production of the Model S in February 2012 and succeeded in ramping production from five units per week at the start of Q3 2012 to 200 units per week at the end of

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[126] Tesla, "Tesla takes more than 500 Model S reservations in a week," *Tesla press release*, April 20, 2010. Subsequent updates to the Model S extended range to over 400 miles (and base price to about $73,000), and a "Plaid" version that could reach 200 mph (for about $88,000).

[127] Anon., "Video: The Tesla Model S is our top-scoring car," *Consumer Reports*, May 2013.

[128] William Walker and Scott Evans, "Tesla Model S beats Chevy, Toyota, and Cadillac for ultimate car of the year honors," *Motortrend*, July 10, 2019.

[129] After struggling to grow sales after the Model S launch, Musk fired Blankenship in 2013.

[130] See, e.g., Clinton Stark, "In photos: Tesla's factory pickup experience (Fremont)," *StarkInsider*, April 22, 2013.

Q3 2012, a rate which the company described as "the critical threshold needed for Tesla to generate positive operating cash flow."[131]

By February 2013, however, Tesla faced a crisis. Despite 15,000 reservations for the Model S on the books in Q4 2012, Tesla was not closing sales and making deliveries fast enough. Musk's biographer, Ashlee Vance, suggests several issues. With no record of high-volume manufacture, Tesla was forced at times, according to von Holzhausen, to purchase parts from "third-rate" suppliers,[132] that sold lower-quality parts. As it raced to meet production targets, Tesla also faced increased quality control issues, which were not missed by its early customers. Musk summarized Tesla's quality issues by stating that "the word of mouth on the car sucked."[133]

Assuming they were undeterred by quality and reliability issues, customers also may have decided to hold out on ordering their Model S as they became aware of new features or colors that Tesla planned to offer, or out of concern that the vehicles would rapidly depreciate. To provide another incentive for its customers to take the leap, Musk declared that he would personally guarantee resale value on the Model S, so that it would be higher than that of a comparable BMW, Audi, Mercedes, or Jaguar. Tesla eventually expanded financing options for those looking for lower monthly payments on the pricey vehicle.[134]

In April 2013, the situation was serious enough that Musk entered into a handshake deal with Google CEO Larry Page for his company to acquire Tesla, provided that Musk would remain Tesla CEO for eight years or until the company produced a mass-market EV.[135] Tesla was saved as an independent company by its strategic pivot, in the midst of the threat of bankruptcy, to reallocate some 500 employees (about 11 percent of the total) toward closing sales of the Model S.[136] By the end of Q1 2013, Tesla delivered 4,900 Model S units, posting an $11-million profit on $462 million in sales. The profitable quarter no doubt contributed to Tesla's success, in May 2013, in raising $660 million in convertible notes as well as $355 million from a public stock issue, which included $45 million that Musk purchased along with

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131 Tesla, "Tesla Motors, Inc. – Third Quarter 2012 Shareholder Letter," *sec.gov*, November 5, 2012.

132 As quoted in Vance, *Elon Musk*, p. 303.

133 Ibid., p. 304.

134 Tesla, "Tesla improves financing product with best resale value guarantee and lower monthly payments," *Tesla press release*, May 3, 2013.

135 Vance, *Elon Musk*, p. 305

136 Based on average employment between 2012 and 2013 of about 4,412.

investing another $55 million in a separate private placement.[137] Tesla used the funds to repay, nine years ahead of schedule, its Department of Energy loan, which, on termination, cancelled DoE warrants to purchase 3,085,011 shares of Tesla's stock at $7.54 per share.[138]

As production and sale of the Model S began to align in Fremont, Tesla's revenues jumped from $413 million in 2012 to $2 billion in 2013, with employment expanding from 2,964 to 5,859. In February 2012, shortly after the Model S entered production, Tesla unveiled the Model X—a large SUV based upon the Model S powertrain and fitted with distinctive gullwing doors. Tesla began delivering Model Xs in September 2015. By the end of that year, Tesla's revenues had doubled to $4 billion and employment was 13,058.

In the interim, sales of the Model S shrank Tesla's annual net losses from $396 million in 2012 to $74 million in 2013. Losses grew to $294 million in 2014, however, as Tesla used some of its newfound financial resources to increase R&D spending from $232 million to $465 million, and capital expenditures from $264 million to $970 million, intensifying investments in its powertrain technology and Model X development and building its first "Gigafactory".[139]

The third generation: Model 3 and Model Y

To ensure that Tesla would have access to a sufficient supply of Li-ion battery cells as its production ramped up to include the Model X and a future Model 3, Tesla in 2013 began pushing Panasonic, its primary battery supplier, to become a strategic partner in the construction of its first "Gigafactory". Tesla recognized that existing global Li-ion battery output was insufficient to supply the millions of EVs it expected to build. Panasonic's role was to supply personnel and setup Li-ion battery cell manufacturing lines, and Telsa would assemble cells into battery packs for Tesla's growing EV business. The scale—35 GWhs—and location of the Gigafactory—close proximity to its Fremont plant—were critical to Tesla's strategy for reducing the cost of current and future EVs. Musk described the tie-up with Panasonic as an opportunity to improve "the machine that builds the machine. If we

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[137] Tesla, "Tesla Motors announces offerings of common stock and convertible senior notes," *Tesla press release*, May 11, 2013.

[138] In other words, Tesla prevented taxpayers from netting, based on an average share price of $80.62 per share in May 2013, realized gains of $226 million if, hypothetically, the DoE had acquired and then sold its Tesla shares. Tesla "Tesla repays Department of Energy loan nine years early," *Tesla press release*, May 22, 2013.

[139] Tesla 2014 10-K, p. 5.

take creative engineers and apply them to design the factory, they make five to ten times more headway than improving the product itself."[140]

Tesla's ambition to build a plant capable of 35 GWh of output (about 400,000-450,000 battery packs annually) meant that Panasonic agreed, in effect, to double global capacity for Li-ion battery cell production, virtually overnight, and in advance of actual demand (*global* production of Li-ion batteries for all uses was about 34 GWh in 2013).[141] Panasonic initially hesitated, notwithstanding an agreement, signed in October 2013, to supply 1.8 billion additional battery cells to Tesla through 2017, enough for approximately 250,000 EVs, and expand its output to do so.[142] In June 2014, Tesla upped the pressure by breaking ground on the new facility without Panasonic, and then, over dinner with JB Straubel, Musk persuaded Panasonic's new president Kazuhiro Tsuga to partner despite the risks. In July, Tesla announced it had reached an agreement with Panasonic.[143] Insofar as Tesla projected it would need yet more battery cells (another 15 GWh, for 50 GWh total), it indicated that it would obtain them through purchase from Panasonic's other existing facilities in Japan.

Panasonic established a new subsidiary, the Panasonic Energy Corporation, located at the 5.4 million square foot Sparks, Nevada location selected by Tesla. The $5-billion facility was backed by a $2-billion investment by Panasonic, an issue of $2.1 billion in convertible debt by Tesla, and incentives from the State of Nevada—after fierce competition with other states vying for the factory—worth about $1.4

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[140] Michael Coren, "Tesla's entire future depends on the Gigafactory's success, and Elon Musk is doubling down," *Quartz*, August 3, 2016.

[141] Brian Jaskula, "2013 Minerals Yearbook: Lithium," *United States Geological Survey*, January 2015. According to this report, at that time, Li-ion batteries for consumer electronics products represented about 64 percent of end-use, versus just 14 percent for EVs. Given that Panasonic was investing in battery capacity specifically for EVs, it was dependent on the time that Tesla would succeed in producing its third generation EV.

[142] To get 250,000 EVs, we assume each 16850 battery cell contained 10-11Wh, and the quantity of cells was used in a 75-kWh battery pack. Elon Musk stated, at the time, that "this expanded agreement with Panasonic is important to Tesla as we continue to increase the pace of production," with Panasonic's president of the Automotive & Industrial Systems Yoshihiko Yamada adding that "Panasonic will increase its production capacity of lithium-ion battery cells to supply Tesla's growing needs as it expands its production of EVs." See Panasonic, "Panasonic and Tesla reach agreement to expand supply of automotive-grade battery cells," *Panasonic press release,* October 30, 2013.

[143] Tesla, "Panasonic and Tesla sign agreement for the Gigafactory," *Tesla press release*, July 30, 2014; Tesla 2014 10-K, p. 68. The supply agreement for 1.8 billion cells through 2017 was equal to approximately 23 GWhs.

billion.[144] The Gigafactory was central to Tesla's plans for a lower-cost EV, as it was expected to reduce Tesla's highest-cost component—battery cells—by 30 percent as Gigafactory 1 approached peak output.[145]

On July 15, 2014, with Model S production underway, Tesla officially announced, via Twitter, that it was developing its third generation EV, the Model 3.[146] As Tesla's "mass market" EV, the Model 3 was set to start at $35,000 after a tax credit, roughly half the price of the Model S. Along with procuring enough batteries, however, Tesla needed to raise more cash to support expansion and tooling of its Fremont facility for the new EV.

In 2015, Tesla returned to the stock market, raising $738 million from a new issue, with CEO Musk purchasing an additional $20 million of Tesla's shares in a separate, private placement. The funding was directed at expanding Tesla's growing business lines, and development of its third generation Model 3, which contributed to R&D expenditures of $834 million and capital expenditures of $1.4 billion during the year.

On March 21, 2016, Tesla began taking $1,000 reservations on the as-yet unveiled Model 3. Ten days later, on March 31, 2016, Tesla officially unveiled the EV, revealing it had already taken 115,000 orders. Musk called the Model 3 "the final step in the master plan, which is a mass market, affordable car."[147] By April 7, 2016, reservations exploded to 325,000, and Tesla posted an article on its blog declaring it "The Week that Electric Vehicles Went Mainstream."[148] Though none had yet been delivered to customers, the Model 3 was positioned to be Tesla's bestselling EV.

The Model 3 was about 20 percent smaller than the Model S, targeting premium vehicles like the BMW's 3 Series. Along with being smaller, Model 3 costs were lowered by the elimination of additional components and controls within the vehicle, moving their functions into a centrally located 15.4-inch tablet display or multi-function buttons on the steering wheel. The Model 3 was also set to benefit from the

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144 Dave Smith, "How Elon Musk cleverly manipulated 7 states to compete for Tesla's huge factory," *Business Insider*, November 14, 2013.

145 Tesla 2013 10-K, p. 14.

146 Other than the original master plan promising a lower cost third generation EV, Musk's August 2012 stock-option grant revealed that portions of the options would vest as Tesla moved from a prototype to a production model.

147 Austin Ramzy, "Tesla Model 3 orders surge even before its unveiling," *New York Times,* April 1, 2016.

148 Tesla Team, "The week that electric vehicles went mainstream," *Tesla press release,* April 7, 2016.

lower-cost batteries produced by Gigafactory 1 in Nevada. Apart from economies of scale expected from the new factory, Tesla and Panasonic in January 2017 announced they had begun producing shotgun-shell sized 2170 Li-ion batteries at the Gigafactory.[149] The new batteries provided greater energy density, energy capacity, and fast-charging capability, all at a lower cost.[150]

With net losses of $889 million on $4 billion in revenues posted in 2015 – primarily from deliveries of its Model S and Model X EVs—Tesla's stock price dropped to an adjusted $9.58 per share. Excitement and hype surrounding the Model 3 reveal helped boost Tesla's stock price 85 percent to a relative peak of $17.69 on April 6, in the lead-up to Tesla's Q1 results. With substantial pre-orders on the books, Tesla raised $1.7 billion from a stock issue in May 2016 to support the production ramp-up of the Model 3. As part of the stock issue, Musk exercised options from his 2009 stock-option grant, with a portion sold to pay Musk's withholding taxes on $1.3 billion in realized gains.

With its first master plan "complete", on July 20, 2016, Tesla published "Master Plan, Part Deux", as a prelude to completing its largest ever acquisition. In it, Musk argued that the goal of moving toward a "solar electric economy"—as mentioned in the original master plan—meant producing integrated solar energy and battery backup systems (while also investing in autonomous driving and ride sharing services as the future of the auto industry).

Tesla announced that it would acquire SolarCity in August 2016, completing the acquisition in November 2016 for $2.1 billion in stock as well as the assumption of $3 billion in debt.[151] Musk had been SolarCity's chairman of the board and a financial backer from its founding in 2006. SolarCity was a Wall Street "unicorn", and a top installer of residential solar power when, in 2014, the company received $750 million in tax credits from the State of New York to purchase a 1.2 million square-foot factory in Buffalo, set up to make solar panels (and later its Powerwall battery backup product or Supercharger components).[152] Holding 22 percent of

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[149] Tesla Team, "Battery cell production begins at the Gigafactory," *Tesla press release,* January 4, 2017.

[150] Michael Coren, "Tesla's cheaper, more powerful battery cell is the perfect embodiment of its factory model," *Quartz*, January 5, 2017.

[151] Tesla Team, "Tesla and SolarCity to Combine," *Tesla press release,* August 1, 2016; Tesla 2016 10-K, p. 74.

[152] Isobel Asher Hamilton, "How Elon Musk transformed his cousins' solar panel company into Tesla Energy, which has faced lawsuits from angry shareholders and consumers," *Business*

SolarCity's shares at the time, Musk was viewed by some as providing SolarCity with a "bailout", a transaction for which Musk was unsuccessfully sued by shareholders.[153] In the midst of its Model 3 production ramp, the SolarCity acquisition helped drive Tesla's total debt to over $6 billion. Hence the company's need to continue seeking sources of cash.

In March of 2017, Tesla netted $400 million from another stock issue to continue supporting its Model 3 ramp, and to retire convertible notes. Tesla also issued $2.8 billion in new convertible debt, as R&D expenses reached $1.4 billion and capital expenditures exploded to $4.1 billion compared to $1.4 billion the previous year. Tesla's capital spending reflected $1.4 billion spent ramping battery production at Gigafactory 1 as well as heavy spending on its automation of Model 3 production in Fremont.

The first Model 3s were delivered to customers on July 28, 2017, as Tesla simultaneously closed in on its 1,000th Supercharger station (while also expanding its sales and service networks). That August, in a Twitter-post, Tesla claimed that "99 percent of the U.S. population" lived "within 150 miles of Supercharger."[154] Tesla was well-positioned to serve an expanding customer base with rapid charging. Anticipation of a successful Model 3 ramp had sent Tesla's stock price soaring, with the stock market value of the company reaching $55 billion. By the end of 2017, however, Tesla had produced just 2,685 Model 3s, despite its claim in the second quarter of 2017 that by the end of that year it would reach a production rate of 5,000 units per week—its "break even" point.[155]

When the first Model 3s began rolling off Tesla's Fremont production lines, Musk declared that Tesla was once more in "production hell," Neither the scaling of battery packs in Nevada nor assembly of Model 3s in Fremont went as expected. Tesla's struggles appeared in its financial performance—Tesla posted a worst-ever $1.9 billion in losses on $11.8 billion in revenue in 2017. Tesla delivered 103,012 EVs, 54,715 Model S sedans and 46,535 Model Xs but just 1,762 Model 3s. Even so, at the end of 2017, Tesla's reservation funds on its EVs had swollen to $854 million,

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Insider, April 29, 2022; Fred Lambert, "Tesla expands beyond solar at Gigafactory New York to meet employment requirements," *Electrek*, June 7, 2021.

153 Tom Hals, "Court upholds Musk's win in $13 billion lawsuit over Tesla-SolarCity deal," *Reuters*, June 6, 2023.

154 @Tesla, *X post*, August 10, 2018.

155 Tesla, "Tesla second quarter 2017 update," *Tesla press release,* August 2, 2017.

which included "net" reservations of the Model 3 of 450,000 units, representing about $450 million.[156]

Hence it was perhaps no accident that Musk opted during this time to lift the veil on the Semi—a class 8 commercial truck, and a new Roadster, each promising 500 to 600 miles of range and revolutionary performance. The Semi was promised for 2019 (but entered pilot production in 2022, three years late), and the new Roadster was promised for 2020 (but has been delayed even longer and is currently slated for production in 2025). In typical Tesla fashion, each EV could be reserved for $5,000, with an additional $50,000 due on the Roadster within 10 days.[157]

To escape production hell, Musk began occupying the Tesla Gigafactory personally, firing the production manager there and appointing Brian Dow, who promised to get the factory to 5,000 battery packs per week. Musk also recruited Marc Juncosa from SpaceX and Steve Davis from the Boring Company (which Musk had founded at the end of 2016). He also brought in a cousin, James Musk, who was working on Tesla's "autopilot" feature, along with Omead Afshar and Tim Watkins to find and fix bottlenecks.[158]

In retrospect, Musk claimed "the first error was trying to automate the process", which should have followed the initial implementation of a more labor-intensive approach.[159] To recover from his mistake, as Issacson wrote, "Musk flipped from being an apostle of automation to a new mission he pursued with similar zeal: find any part of the line where there was a holdup and see if de-automation would make it go faster."[160] In addition to de-automating, Musk and his trouble-shooting team also sought out design changes to reduce the cost of producing the battery packs for the Model 3.

By April of 2018, the Gigafactory was running well. At Fremont, however, Tesla did not have the capacity to reach its 5,000 unit per week target. Tesla's stock was being shorted by hedge-fund managers like David Einhorn, who were aware of that fact, and Musk was micro-managing the company's production lines in an effort to

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156 Tesla, "Tesla 1Q 2018 vehicle production and deliveries," *Tesla press release*, April 3, 2018. Net reservations were those left after customers, no longer willing to wait, canceled their reservations.

157 Bill Chappell, "Tesla unveils its electric 'Semi' truck, and adds a Roadster," *NPR*, November 17, 2017.

158 Isaacson, *Elon Musk*, p. 271.

159 As quoted in ibid., p. 274.

160 Ibid.

force a "surge" of production, opting to speed up certain steps, eliminating parts, or removing safety sensors that could stop the production line, and de-automating steps in the process. By May 2018, Tesla had reached a production rate of 3,500 units per week. To fill the gap, the company erected a tent outside the Fremont factory to set up a third assembly line, with no robots. With that line completed in June, Tesla succeeded in achieving a production run rate of 5,000 units per week on July 1, 2018.

Tesla's second-quarter 2018 letter to shareholders was triumphant, claiming that "in the end, it was all worth it: A total vehicle output of 7,000 vehicles per week, or 350,000 per year, should enable Tesla to become sustainably profitable for the first time in our history—and we expect to grow our production rate further in Q3." The Model 3 was a hit in the U.S., taking 52 percent of the premium mid-size sedan segment. Tesla noted that "the total addressable market for Model 3 is much larger than mid-sized premium sedans," because "we are drawing customers from many other segments, including non-premiums sedans and hatchbacks."

The experience of ramping up the Model 3 is what Musk described as the moment Tesla became "a real car company".[161] Tesla was grabbing market share away from established automakers, despite offering only EVs, and Musk's 2012 stock-option grant, bestowed on him as CEO in August 2012, was hitting the performance criteria required for it to pay off. As vesting requirements, Musk had to see Tesla through not only to developing the Model 3 to production stage, but also to churning out an aggregate of 300,000 vehicles (which could include the Model S and Model X). Notably, Tesla ended up building its 300,000th EV in the midst of its "production hell", and largely without sales of the Model 3, on the strength of sales of the S and X.[162]

Though Musk had begun designing a new stock-option package for himself in 2017, equivalent to 12 percent of Tesla's outstanding stock, the grant was not officially made until March of 2018. Assuming that Tesla could overcome its production challenges, the company was on the cusp of riding a "growth wave", and despite lofty vesting requirements assigned to the shares in the 2018 stock-option package, the company's internal calculus was that it was probable that the requirements would be met, along with commensurate higher revenues and stock price.[163] Yet, despite

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161 As quoted in ibid., p. 284.

162 Fred Lambert, "Tesla confirms having produced its 300,000th electric car," *Electrek*, February 14, 2018.

163 Kathaleen St. J. McCormick, "Tornetta v. Musk," *Court of Chancery of the State of Delaware*, January 30, 2024.

selling 244,920 EVs in 2018, almost doubling its revenues from $11.8 billion to $21.5 billion, and posting profits of $451 million in the third and fourth quarters of 2018, Tesla recorded a total net loss of $976 million in 2018.

The shorting of Tesla's stock intensified as its stock price reached new peaks in 2018, at which time it remained unclear whether Tesla would succeed in meeting its own production targets. Musk described Tesla's shorts as "leeches on the neck of business", working with a "degree of inside information" that was "insane".[164] Hedge fund managers like David Einhorn and Jim Chanos routinely, and sometimes correctly, highlighted that Tesla's capability to produce the EVs promised did not exist, while negative news articles and social media posts plagued the company.

Perhaps to damage the short sellers,[165] Musk infamously tweeted on August 7, 2018, that he would take Tesla private (i.e. de-list the stock) for $420 per share, claiming that he had "funding secured". After Tesla's stock price jumped 11 percent on the news, short sellers were estimated to have lost $1.3 billion, with cumulative losses amounting to $3 billion.[166] In October 2018, as part of a settlement with the Securities and Exchange Commission (SEC) that included Musk and Tesla each paying a $20 million fine, the tweet cost Musk his position as chairman of the Tesla board for three years (Musk has since not reclaimed that position). Tesla also had to appoint two new independent board members, and Musk's future tweets had to be vetted prior to his posting them.[167]

Musk's ire at the SEC's attack on his strategic control was revealed in a *60 Minutes* interview with Leslie Stahl in 2018, wherein he said he had "no respect for the SEC",[168] and in 2022 when he claimed that he was "forced to concede to the SEC unlawfully. Those bastards." The "gun to [his] child's head", as he put it, actually came, however, in the form of financial pressure: banks were refusing to continue

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164 As quoted in Issacson, *Elon Musk*, p. 277.

165 Mark Matousek, "SEC reportedly investigating whether Elon Musk tried to hurt short-sellers with his 'funding secured' tweet," *Business Insider*, August 16, 2018.

166 Tae Kim and Leslie Picker, "Elon Musk's tweet about going private costs Tesla short sellers $1.3 billion," *CNBC*, August 8, 2018.

167 U.S. Securities and Exchange Commission, "Elon Musk settles SEC fraud charges; Tesla charged with and resolves securities law charge," *SEC press release*, September 29, 2018.

168 Lesley Stahl, "Tesla CEO Elon Musk: The 60 Minutes Interview," *CBS News*, December 9, 2018.

lending to him if he did not reach a settlement with the SEC, which in effect threatened Tesla with bankruptcy.[169]

Key to Tesla's growth going forward, and profitability that could free Musk from future challenges to his strategic control by meeting the performance requirements of his 2018 stock-option package, was expanding access to international auto markets, starting with China. From 2013, China was rapidly transitioning from the world's largest auto market to its largest EV market. Though Tesla began exporting Model S sedans to China in 2014, its products were subject to transportation charges, tariffs, and import duties that raised their cost and dampened sales. Tom Zhu, who joined Tesla in 2014 and became its vice president of greater China, helped boost sales by committing $500 million to increase made-in-China components.[170] In 2018, however, despite China being the largest vehicle market in the world, Tesla's $1.7 billion in sales there were just eight percent of its revenues.

Musk brought in a friend and native Chinese, Robin Ren, to figure out how to boost Tesla's business in China. According to Ren, Telsa would never succeed in China unless Musk established manufacturing there. Ren and Musk eventually convinced Chinese government officials to permit Tesla to set up manufacturing in China without, as required by law, entering into a joint venture with a local producer. In April 2018, China's National Development and Reform Commission revised rules, to take effect in 2022, granting an immediate exception to "factories producing only EVs".[171]

After a year of negotiations, Tesla signed an agreement on July 10, 2018, becoming the first and only foreign automaker to own and control its operations in China.[172] Shanghai was selected as the location, and Tesla broke ground on its third Gigafactory in January 2019, placing Tom Zhu in charge of its operations with Grace Tao responsible for communications with government officials.[173] By October 2019, just 10 months later, Tesla's 9.3-million square foot Shanghai Gigafactory was producing the Model 3. Tesla financed the plant with $521 million[174] in low-interest

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169 Hyunjoo Jin and Sheila Dang, "Musk says U.S. SEC 'bastards' forced settlement over Tesla tweets," *Reuters*. April 14, 2022.

170 Morrison, *Tesla*, p. 405.

171 Ibid, pp. 406-407.

172 Sean O'Kane, "Tesla signs agreement to build cars in China," *Verge*, July 10, 2018.

173 Tesla, "Tom Zhu," *Tesla Corporate Governance* (accessed September 2, 2024); Morrison, *Tesla*, p. 408.

174 Bloomberg, "Tesla secures up to $521 million in China bank loans for plant," *Los Angeles Times*, March 7, 2019.

loans from Chinese banks (with about $2 billion in total credit available to Tesla to utilize for the expansion), and a favorable corporate tax rate of 15 percent.[175]

The Shanghai Gigafactory brought under one roof both battery pack and Model 3 manufacture. As part of its agreement, Tesla committed to allocating 14.08b RMB (about $2 billion) in capital expenditures to the plant over time and to generating 2.23b RMB (about $311 million) in taxes annually by the end of 2023. The factory benefited from Tesla's experience and learning from "production hell". In its Q1 2019 letter to shareholders, Tesla stated that "learning from our experience, we can now build a second-generation Model 3 line in China that we expect will be at least 50% cheaper per unit of capacity than our Model 3-related lines in Fremont and at Gigafactory 1."[176] An important source of cost savings, and in a break with its partnership with Panasonic, Tesla decided to source Li-ion batteries in China from CATL, the China-based battery giant, with which it entered into an agreement in 2020 to source low-cost LFP batteries, subsequently extending the agreement through 2025.[177] It also inked a deal with South Korea's LG Chem, which manufactured Li-ion batteries in China.[178]

In the midst of its expansion into China, in March of 2019, Tesla unveiled the Model Y, an SUV built on the Model 3 platform, priced at $48,000. As with the Model 3, the Model Y was positively received. In April 2019, Tesla hosted the company's "Autonomy Investor Day" to showcase the company's developments in "self-driving" technology, offering test drives to Tesla shareholders.[179] Then in May 2019, Tesla raised $848 million from the stock market to bolster its cash position. In January 2020, Tesla added the Model Y to its production lines in Fremont and began producing Model Ys in Shanghai that December. In 2019, sales in China were up 70 percent, to $3.0 billion. In 2020, sales more than doubled to $6.7 billion, now 21 percent of the company's total global revenues. In 2020, on the strength of its sales there, Tesla became the most subsidized automaker in China, collecting $325

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175 According to Tesla 2019 10-K, pp. 103, and Tesla 2020 10-K, p. 9, it had both.

176 Daniel Sparks, "Tesla to make a surprise announcement in China," *Yahoo!Finance*, May 28, 2019.

177 Yilei Sun and Tony Munroe, "Chinese EV battery maker CATL extends deal with Tesla," *Reuters*, June 28, 2021.

178 Hyunjoo Jin, Makiko Yamazaki, Yilei Sun, and Edward Taylor, "Exclusive: LG Chem to double China battery capacity to meet Tesla demand - sources ," *Reuters*, December 1, 2020.

179 Tesla, "Tesla to host autonomy investor day," *Tesla press release*, April 3, 2019.

million.[180] In Q1 2021, Tesla named the Shanghai Gigafactory its new primary export hub, replacing Fremont as the source of Model 3s and Model Ys destined for non-U.S. markets.

Since operations in China began in Q4 2019, through Q2 2024, Tesla has posted 20 consecutive profitable quarters, generating $36.5 billion in net income. The price of Tesla's shares skyrocketed from $15.43 on October 4, 2019 (before the announcement of Q4 results) to an historic peak of $409.90 on November 4, 2021, just before Tesla posted $5.5 billion in net income for the year, blowing away the $721 million booked in 2020. Tesla's market capitalization peaked at $1.24 trillion and, with over 20 percent of Tesla's shares in Musk's possession, established the Tesla CEO as the richest person in the world.

The valuation of Tesla was extreme; in 2021, Tesla booked $53.8 billion in revenue, about 47 percent of the sales generated in that year by, for example, GM. It delivered 936,222 EVs in 2021, compared to 6.3 million units sold by GM, which included its competing EVs. At that level, however, Tesla had 21 percent of the global market for EVs, establishing it as the global leader, with no major competitors outside of China.[181] What is more, its Fremont factory was deemed the most productive in the U.S. automobile industry, with a production run of 8,550 units per week (444,600 per year) beating the output of U.S. factories operated by Toyota, BMW, and Ford.[182]

Along with the hype being generated by Tesla's investments in artificial intelligence and new products (the Cybertruck was announced in November 2019), Musk hosted, during Tesla's September 22, 2020 annual general meeting, a "Battery Day" event, laying out the virtually unlimited growth needed to electrify the global transportation and energy economies as well as a roadmap for Tesla to reduce the cost of Li-ion batteries used for its EVs by 50 percent. Telsa's presentation described how, by investing in both better design—a new, larger 4680 cylindrical battery—and better manufacturing that would incorporate, for example, dry cell technology (obtained via its acquisition of Maxwell), higher productivity measured by more GWhs of batteries produced per square foot could be achieved.

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[180] Simon Alvarez, "Tesla becomes China's most subsidized EV maker by receiving $325M in 2020," *Teslarati*, September 9, 2021. In part, Tesla's ability to collect on subsidies reflected its satisfaction of China's changing electric range requirements.

[181] José Pontes, "Tesla #1 in world BEV sales by big margin—2022 World EV Sales Report," *Cleantechnica*, 2023.

[182] Dan Mihalascu, "Tesla's Fremont is the most productive car plant in North America," *InsideEVs*, January 24, 2022.

Musk used Tesla's stock price momentum to carry out three stock issues in 2020, one in each of February, September, and December, raising $12.3 billion in total. Now profitable, however, Tesla's share issues were used to strengthen the company's balance sheet, and for general corporate purposes. Tesla used its growing supply of cash and profits to pay down its accumulated debt, and increase both R&D and capital expenditures, which grew in part to support new products.

It also used its funds to accelerate expansion of its existing EV business. Tesla broke ground on two new Gigafactories in 2020, a two-million square foot facility in Berlin-Brandenburg Germany in June and a ten-million square foot facility in Austin Texas in July (built to accommodate production of 4680 battery cells as well as EVs), with both beginning to produce EVs in the middle of 2022. For construction of the Texas factory, Tesla received $64.5 million in state and local subsidies.[183] In September 2021, Tesla began construction of a 500,000 square foot "Megafactory" in Lathrop, California, to produce the company's megapacks for utility-scale grid energy storage projects.[184] Tesla's expansion into Germany was a response to Germany's accelerating EV transition, driven by its stated goal of putting 15 million EVs on German roads by 2030 and coupled to "purchase grants" that subsidized the purchase of qualifying EVs by up to €9,000.[185]

Accompanying these expansions were capital expenditures of $3.2 billion in 2021 (12 percent of revenues) and $6.5 billion (9 percent of revenues) in 2022. As Tesla raced to support deliveries that were approximately doubling every two years, it added to its headcount. In 2021, Tesla had 99,290 employees, and one year later, employment reached 127,855, only to expand against to 140,473 by the end of 2023.

To date, Tesla's Shanghai Gigafactory, which began producing Model 3s in October 2019 (Table 3),[186] is Tesla's most productive. In November 2022, the Shanghai

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183 Good Jobs First, "Subsidy tracker individual entry, Tesla," *Good Jobs First* (accessed September 6, 2023); Isabelle Gius, "Tax breaks cushion Tesla's Texas landing," *American Prospect*, April 25, 2022.

184 Tesla also plans a Megafactory in Shanghai, China, to start production in 2025. See: Phate Zhang, "Tesla begins construction of Shanghai Megafactory," *CNEVPost*, May 23, 2024.

185 Germany paid €10 billion in subsidies from 2013 through 2023, for 1.4 million BEVs, and 800,000 PHEVs, helping to establish it as the largest market for EVs in Europe. Germany abruptly ended its program at the end of 2023 due to budget cuts, only to revitalize them in 2024. See Michał Kędzierski, "Unplugged. The uncertain future of electromobility in Germany," *Centre for Eastern Studies*, March 13, 2024; Reuters, "German government agrees proposals for tax relief on EVs," *Reuters*, September 4, 2024.

186 Laura He, "Tesla delivers first China-made Model 3s to its own workers," *CNN*, December 30, 2019.

factory's 100,291-unit output indicated, for the first time, a capability to produce over 1 million Model 3 and Model Y EVs per year, making it Tesla's most productive plant.[187] The Shanghai Gigafactory now "consistently produces" about half of Tesla's EVs, and more than the combined output of its remaining factories.[188] In comparison, Tesla's Fremont, California Gigafactory currently can produce approximately 560,000 EVs each year, with an estimated maximum capacity of 660,000.[189]

Table 3: Tesla's manufacturing locations as of 2022 and year opened

Primary Manufacturing Facilities	Location	Owned or Leased	Sq Feet	Opened/ Acquired
Gigafactory Texas	Austin, Texas	Owned	10,000,000	2022
Fremont Factory	Fremont, California	Owned	5,500,000	2010
Gigafactory Nevada	Sparks, Nevada	Owned	5,400,000	2016
Gigafactory Berlin-Brandenburg	Grunheide, Germany	Owned	2,240,000	2022
Gigafactory Shanghai	Shanghai, China	*	4,554,000	2019
Gigafactory New York	Buffalo, New York	Leased	1,200,000	2017
Megafactory	Lathrop, California	Leased	440,538	2022

***** Telsa "owns" the land for 50 years.

Sources: Tesla 10-K filings, various years.

In 2021, Musk announced he was moving Tesla's headquarters to Austin Texas, the site of the company's largest, 10-million square foot factory. Accounting for Austin's massive footprint is the inclusion of plans to produce 60 GWh of new 4680 Li-ion batteries and battery packs, enough for approximately 750,000 EVs, depending on battery pack size. The 4680 battery cells, announced on Tesla's "Battery Day" in 2020, exploit a new, larger "tabless" form factor to exploit further economies.

Consider that Tesla's booming production in China is capable of consuming approximately 75 GWhs of batteries each year, equal to more than two Panasonic-Nevada Gigafactories.[190] Panasonic plans to continue supplying Tesla's growing EV business. Following Tesla's expansion into China, however, Panasonic began

[187] Jiri Opletal, "Tesla prepares for Giga Shanghai phase 3 expansion to produce 25,000 USD vehicle," *CarNewsChina*, December 6, 2023; Al Root, "Tesla boosted output at its plant in China. It had to," *Barron's*, September 5, 2023.

[188] Mark Kane, "Half of all Tesla EVs are made In China," *InsideEVs*, April 10, 2024.

[189] Tesla, Q4 2023 shareholder deck, *Tesla*, January 24, 2024, p. 9.

[190] Our rough estimate assumes 1,000,000 EVs with 75 kWh battery packs, on average.

seeking new partnerships, starting with Toyota in 2020.[191] Panasonic sold its Tesla shares in 2021, netting about $3.6 billion, and then in 2022 broke ground in Kansas, with plans to produce innovative 2170 cells for other automakers in a $4-billion plant, with $1 billion in subsidies from the State of Kansas.[192] It planned a third battery plant in Oklahoma, but decided not to move forward, given a slowdown in the U.S. EV market, and despite being offered $700 million in incentives by the state.[193] As more automakers ramp up EV production, Tesla will lose leverage over suppliers like Panasonic, which, aside from the gains reaped from selling its shares of Tesla stock, claimed it did not profit from its relationship with Tesla.[194] Musk's pressure for cost reductions and expanding output in the face of significant uncertainty, along with his penchant for flagrant, headline-grabbing behavior, likely has played a role in Panasonic's decision to pursue its battery innovation strategy independently of Tesla.[195]

5. How Elon Musk has maintained strategic control of Tesla

Musk's enormous stock-option packages are about his control, not his compensation

On June 13, 2024, Tesla shareholders voted by a margin of almost four to one to re-ratify a bounteous stock-option package that the Tesla board of directors had granted to CEO Elon Musk in 2018,[196] but which the Delaware Court of Chancery had rescinded five months earlier.[197] With that grant in place, Musk can exercise, at a time of his choosing, options to purchase 303,960,630 Tesla shares at a strike price of $23.33. Tesla's closing stock price on June 13 was $182.47. If, hypothetically,

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[191] Panasonic, "Toyota and Panasonic decide to establish joint venture specializing in automotive prismatic batteries," *Panasonic press release*, February 3, 2020.

[192] Mufit Yilmaz Gokmen, "Mass(ive) production and price cuts: How did the Tesla-Panasonic alliance thrive over the years?" *Globalfleet*, January 23, 2024.

[193] Ibid; Mariko Katsumura, Daniel Leussink, and Akash Sriram, "Panasonic says Oklahoma no longer candidate for new battery plant," *Reuters*, December 20, 2023.

[194] Jen Mc, "Rising with Tesla, falling to Toyota: The Panasonic battery chronicles," *Medium*, December 8, 2023; Gokmen, "Mass(ive) production and price cuts".

[195] Tim Higgins and Takashi Mochizuki, "Tesla needs its battery maker. A culture clash threatens their relationship," *Wall Street Journal*, October 8, 2019.

[196] Tesla, Form 8-K Report to the Securities and Exchange Commission, June 1, 2024.

[197] Delaware Court of Chancery, "Post-trial opinion" Richard J. Tornetta v. Elon Musk, Robyn J. Denholm, Antonio J. Gracias, James Murdoch, Linda Johnson Rice, Brad W. Buss, and Ira Ehrenpreis, and Tesla, Inc., In the Court of Chancery of the State of Delaware, April 25, 2024.

Musk had exercised these options on June 13, he would have reaped realized gains of $48.4 billion before taxes and $30.5 billion after taxes.

In an age when the public has become used to CEO compensation that can be described as sky-high, the unprecedented size of Musk's potential haul is, by comparison, in outer space. In both the Delaware court and the media, the question has been whether it is fair for one person, who was already among the richest in the world,[198] to be paid so much. That focus of the debate, however, misses the purpose of the 2018 stock-option grant.

While it takes the *form of a pay package*, the point of the 2018 option grant is to enable Musk to secure his control over the allocation of Tesla's resources by increasing his voting power in the corporation. It was for this reason that, as proportions of Tesla's outstanding shares, the number of shares in Musk's 2009 stock-option package was eight percent, in his 2012 package five percent, and in his 2018 package twelve percent. As we discuss below, the vesting of the options depended on the achievement of goals related to Tesla's productive performance. Musk and his board recognized that, should the company be successful as a mass-producer of high-quality EVs, Musk's control could be challenged by hedge-fund activists as "predatory value extractors". As has happened with so many other profitable companies in the United States, including those seeking to invest in the EV transition, the activists have been able to make use of the U.S. proxy-voting system to demand that a company use its profits to do stock buybacks for the purpose of giving manipulative boosts to the company's stock price—assisting the hedge funds in reaping higher realized gains when they sell their shares on the market.[199]

In 2018, with the Model 3 ready for mass production, Musk and his board knew that the company was about to transition from perennial losses to burgeoning profitability, and hence could become even more vulnerable than previously to an attack by predatory value extractors. In constructing the "compensation" package, the board decided that, with an additional 12 percent of the outstanding shares, Musk would have sufficient voting power to secure his strategic control. The six board members—Antonio J. Gracias, Ira Ehrenpreis, Brad W. Buss, Robyn J. Denholm, Linda Johnson Rice, and James Murdoch—who signed off on Musk's 2018 stock-

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198 Forbes, "The real-time billionaires list," *Forbes* (accessed August 8, 2024).

199 Matt Hopkins and William Lazonick, "How GM's $10-Billion Buyback May Ice Its EV Transition," *Institute for New Economic Thinking*, December 18, 2023; William Lazonick and Jang-Sup Shin, *Predatory Value Extraction: How the Looting of the Business Corporation Became the US Norm and How Sustainable Prosperity Can Be Restored*, Oxford University Press, 2020.

option package understood that full achievement of the "specific milestones" for vesting "would make Tesla one of the most valuable companies in the world with a market capitalization of at least $650 billion — more than 10x today's value", enabling Musk to realize gains of tens of billions of dollars.[200] This potential bonanza for Musk, which took the form of the 2018 "compensation" grant, would, as a corollary of attaining this control objective, propel him into the stratosphere of the world's richest.

It is a worthy government-policy objective to prevent (even) a successful entrepreneur and manager, such as Musk has been at Tesla, from getting so filthy rich. In terms of the success of the EV and the role of U.S.-based companies in it, however, the overriding policy issue is how Musk will use—or abuse—his strategic control over resource allocation at the world's leading EV producer. Anyone concerned with the EV transition should be asking whether Musk as Tesla's CEO will make resource-allocation decisions that support value creation in the form of higher-quality, lower-cost EVs or, to the contrary, simply enable value extraction that results in financial predators, possibly including Musk himself, becoming wealthier than they already are.

We begin our analysis of this critical question by, as a first step, explaining how the stock-option packages that CEO Musk was granted in 2009, 2012, and 2018 have been the mechanisms by which he has been able to increase his voting power at Tesla. Then we document how, through the accumulation of Tesla shares, Musk's percentage of voting power at Tesla has changed over the past 15 years. We outline how, in the era of "maximizing shareholder value", financial predators can challenge Musk's control of Tesla in ways that undermine EV innovation. That discussion raises the question of why Tesla, with Musk in control, did not adopt dual-class shares or delist from the stock market as ways of shielding its CEO from the "market for corporate control". Finally, we ask whether, for the sake of the EV transition, Musk should remain Tesla's CEO.

Measuring Musk's CEO "compensation"

For all the attention bestowed on Musk's stock-option packages, almost all media outlets, think-tanks, labor unions, and academics routinely report a highly misleading measure of his stock-based pay, based on "fair value" accounting. So-called fair-value measures of stock-based executive compensation are estimates of the value of the stock options and stock awards based upon *grant-date* stock prices.

[200] Tesla DEF 14A 2018 Proxy Statement, p. 1.

But, as we have explained in several publications,[201] the point of stock options and stock awards is to incentivize executives to make decisions that increase the company's stock price in the future. Insofar as the stock price rises from the date of the grant to the date when the stock option is exercised or the stock award vests, executives are rewarded financially by *realized gains* (see Table 4).

Table 4. Elon Musk's total compensation, grant-date vs. realized-gains measures of stock-based pay, 2009-2023

Year	Total grant-date pay ($000s)	Total realized-gains pay ($000s)
2009	24,133	240
2010	33	33
2011	33	33
2012	78,150	39
2013	70	33
2014	35	52
2015	38	38
2016	46	1,340,150
2017	50	50
2018	2,284,045	56
2019	24	24
2020	0	0
2021	0	23,452,910
2022	0	0
2023	0	1,861
2009-2023	**2,386,657**	**24,795,520**

Source: Tesla DEF 14A Proxy Statements, 2011-2024.

[201] Matt Hopkins and William Lazonick, "The Mismeasure of Mammon: Uses and Abuses of Executive Pay Data," Institute for New Economic Thinking *Working Paper* No. 49, August 29, 2016; William Lazonick and Matt Hopkins, "Corporate executives are making way more money than anyone reports," *The Atlantic*, September 15, 2016; William Lazonick and Matt Hopkins, "If the SEC Measured CEO Pay Packages Properly, They Would Look Even More Outrageous," *Harvard Business Review*, December 22, 2016; William Lazonick and Matt Hopkins, "Comment on the Pay Ratio Disclosure Rule," *public comment* to the U.S. Securities and Exchange Commission, March 21, 2017.

It is the realized gains from stock-based pay, not the grant-date (i.e., "fair value") measure, that flow into the executives' bank accounts and on which they pay personal taxes (generally at ordinary tax rates) to the U.S. Treasury. Moreover, it is the realized gains on stock-based compensation that the employing corporation treats as a compensation expense in its tax filings. In Elon Musk's case, the dramatic difference between the two measures of executive pay is shown in Table 4.

For the 15 years from 2009 through 2023, Musk's actual realized-gains pay was *$24.8 billion*, while his estimated grant-date pay was less than one-tenth of that amount. In most years, under either measure, his only recorded compensation was a salary ranging from $24,000 to $56,000, based on California's minimum wage. For many years, Musk made a point of accepting only $1 as his base salary, cutting that to $0 from 2016 to 2018, and in 2019, asked Tesla not to record even the California minimum wage. No matter. His 2009 stock-option package, with a *grant-date value of about $24 million* yielded Musk *realized gains of $1.3 billion* when he exercised the options in 2016, while his 2012 stock-option package with a *grant-date value of $78 million* yielded him realized gains of *$23.5 billion* when he exercised them in late 2021, toward the end of their ten-year expiration date.

Musk's 2023 compensation of $1.9 million (chump change for him) was the result of the realized gains from his exercise of two 2013 option grants as part of Tesla's company-wide patent incentive program, with a ten-year expiration date. Musk exercised the options in 2023, acquiring 10,500 shares with an average realized gain of about $177 per share.

Use of the grant-date measures of stock-based pay ignores the incentive design and function of Musk's stock options, resulting in glaring errors in reporting his actual pay. For example, in its annual report on the "100 Most Overpaid CEOs" for 2021, based on grant-date measures, the progressive think-tank *As You Sow* fails to include Musk in their list because, using *grant-date accounting, they record his 2021 compensation as zero.*[202] *In fact, Musk's money-in-the bank compensation was $23.5 billion,* as he exercised his options from the 2012 grant.

Moreover, *As You Sow* will never report that $23.5 billion—*by far the biggest payday of any CEO in history thus far*—in any of its future compensation reports. In making this error, *As You Sow* is not alone. For example, in its report on the 2021

[202] Rosanna Landis Weaver and Melissa Walton, "The 100 most overpaid CEOs," *As You Sow*, February 2022.

pay of CEOs of companies included in the S&P 500 Index, *Wall Street Journal* places Musk dead last at $0.[203] That is, frankly, absurd.

It gets worse. In presenting its list of the highest-paid executives in 2021, the *New York Times* published an article, "How Elon Musk helped lift the ceiling on C.E.O. pay", which refers to the grant-date value of Musk's 2018 option package but ignores his actual 2021 income from his 2012 grant.[204] With a grant-date value of $2.3 billion, Musk's 2018 stock-option package undoubtedly encouraged other companies to increase their stock-option and stock-award grants to their senior executives (as the *New York Times* argues in its story on the highest-paid executives in 2021).[205] To add to the confusion, an *Associated Press* story makes an illogical comparison between Musk's potential realized gains of $44.9 billion from the 2018 option package and the median grant-date measure of the 2023 pay of CEOs of companies included in the S&P 500 Index.[206] Grant-date valuations of stock options or stock awards never flow to the executives who receive stock-based pay. Until he decides to exercise some of or all his stock options, Musk will not pocket one penny of realized gains from his 2018 stock-option grant.

By the end of 2023, Tesla had achieved the vesting requirements of the 2018 grant, but Musk has chosen not to exercise the options. Yet, in the discussions of whether Tesla shareholders would reapprove his 2018 option package, the media, pundits, and analysts have placed their value at around $50 billion, a hypothetical *realized-gains measure*, based on the difference between Tesla's prevailing stock price and the grant-date stock price, if Musk had actually exercised his options on the date in question.[207] *As You Sow*, *Wall Street Journal*, *New York Times*, and other organizations that rely on grant-date measures will never report Musk's actual realized gains from the reapproved 2018 package—not even when, probably close to their expiration date of January 19, 2028, Musk decides to exercise the options.

The 2009, 2012, and 2018 stock-option grants required that, as conditions for the shares to vest, Tesla would have to succeed, under Musk's leadership, in developing, manufacturing, and delivering innovative EVs. In 2009, Musk received options to

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[203] Inti Pacheco and Theo Fracis, "The highest paid CEOs in the S&P 500: The top pay packages in 2021," *Wall Street Journal*, May 15, 2022.

[204] Peter Eavis, "How Elon Musk helped to lift the bar on C.E.O. pay," *New York Times*, June 25, 2022.

[205] Ibid.

[206] Tom Krisher, "How Elon Musk's $44.9 billion pay package compares with the most generous plans for other U.S. C.E.Os," *Associated Press*, June 15, 2024.

[207] Al Root, "Is Elon Musk worth some $50 billion?" *Barron's*, June 14, 2024.

purchase a split-adjusted 101 million Tesla shares, equal to eight percent of Tesla's outstanding shares, with vesting of half of the options conditional on the development and rollout of the Model S, Tesla's second-generation EV.[208] In 2012, as Musk's 2009 grant was close to fully vested, he was granted 79 million shares in stock options, equal to five percent of Tesla's outstanding shares. The options vested if and when Tesla completed development and rollout of the Model X and the Model 3 and succeeded in manufacturing a cumulative total of 300,000 vehicles. His one financial target was to achieve 30 percent gross margins for four quarters—a metric never met.[209] The 2018 stock-option grant vested in 12 tranches over time, with the options in each tranche equal to one percent of Tesla's outstanding shares, conditional upon Tesla hitting escalating targets for revenue, adjusted earnings before interest, taxes, depreciation, and amortization (EBITDA), and market capitalization.[210]

It should be noted that most stock-option packages granted to senior executives in the United States vest over periods of one to four years from the date of the grant *without* any additional metrics added as vesting requirements. If the stock price rises above the exercise (grant-date) price, the executives can realize gains from exercising the options, even if the stock-price increase results from the use of stock buybacks to give the price a manipulative boost. In contrast, vesting conditions of all three of Musk's option packages have been largely related to the success of Tesla's innovation strategy.

Given that Musk has not yet realized any gains on his 2018 option package, does that mean that he is short of cash? Hardly. In addition to his stock-option packages, Musk has "founder shares" that he received for investing $291.2 million in Tesla. At Tesla's closing stock price of $182.47 on June 13, 2024, these shares were worth $81.9 billion. If Musk needs cash, the liquidity of the stock market means he can easily sell some of his shares at any time of his choosing. Indeed, such was the case in 2022 when Musk sold 94.1 million of his Tesla shares, worth $22.9 billion, to provide just over half of the fund for his purchase of Twitter.[211]

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208 Tesla DEF 14A 2011 Proxy Statement, p. 27. Tesla had a 5-for-1 stock split on August 31, 2020, and a 3-for-1 stock split on August 25, 2022.

209 Tesla DEF 14A 2013 Proxy Statement, pp. 33-34.

210 Tesla DEF 14A 2018 Proxy Statement, pp. 11-17.

211 Q.ai, "Elon Musk sells another $3.6 billion in Tesla stock to prop up Twitter," *Forbes*, December 29, 2022.

In fact, however, to maintain his voting power, Musk seeks to avoid selling his Tesla shares. As an alternative, he borrows money, using shares as collateral.[212] On December 4, 2020, Musk had borrowed $515 million against 265.0 million Tesla shares, which had a market value on that date of $52.9 billion—more than 100 times the amount of the loans on those shares. On April 19, 2024, Musk had 238.4 million shares pledged for loans, with a market value of $35.1 billion. The cost of servicing this debt (which is unknown to the public) represents a cost that Musk is willing to pay to avoid selling some of his shares and diluting his voting power.

Along with the fact that he is CEO or a major shareholder of other companies, where he can also sell, or borrow against, his shares, Musk neither needs nor depends on drawing regular compensation from Tesla to pay the bills–particularly since he has sold off all his mansions and now lives in his tiny home in Texas.[213]

Musk's strategic control

As much as Musk's stock-option packages have helped propel him to the top of the world's-wealthiest list, for him, stock options have never been about compensation. They have been about substantially shoring up his voting control at Tesla as the company fulfilled its "master plan" of developing, manufacturing, and delivering a succession of innovative and increasingly affordable EVs.

Musk is clear about what was at stake for him in the vote to reapprove his 2018 stock-option grant (he is far more prone than other CEOs to say the quiet part out loud). On January 15, 2024, he X-posted:

> The reason for no new "compensation plan" is that we are still waiting for a decision in my Delaware compensation case…I put "compensation plan" in quotes, because, from my standpoint, this is primarily about ensuring the right amount of voting influence at Tesla.[214]

Musk claims that he needs the voting power of 25 percent of Tesla's outstanding shares to be "influential", but "at 15% or lower, the for/against ratio to override me makes a takeover by dubious interests too easy."[215] At most publicly listed

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[212] Tim Higgins, "Elon Musk, tech's cash-poor billionaire," *Wall Street Journal*, May 8, 2020.
[213] Sissi Cao, "Rare photo of the Elon Musk's $50,000 tiny home shared by biographer," *Observer*, August 7, 2023.
[214] @elonmusk, *X post*, January 15, 2024.
[215] Ibid.

companies, a CEO with 50.1 percent of shares outstanding, each with one vote, could hand pick their board of directors and exercise absolute control over the company's strategy. Dissenting shareholders would not have sufficient votes to choose board members to carry out their agenda, including possibly ousting the current CEO or challenging their strategy. Tesla's bylaws assign one vote per common share but require a supermajority of 66.67 percent of all outstanding shares to confer such power.[216]

Hence, Musk would need voting power of 33.34 percent to be completely invulnerable to attack. With 25 percent of shares outstanding, Musk would enjoy de facto control of Tesla; a corporate raider would have to secure (through shareholding and proxy) 89 percent of the non-Musk votes to oust him.[217] Reduced to 13 percent as a result of the Delaware court's rescission of the 2018 option grant, however, 77 percent of the remaining votes could throw the EV man out.

As shown in Table 5, as of March 31, 2024, shares beneficially owned (SBO) by Musk provided him with up to 20.5 percent voting power, with each share having one vote. This figure includes three different components. The first component is "shares in hand", which Musk owns outright, acquired by his $291.2 million investment in Tesla plus shares retained after the exercise of stock options in 2016 and 2021. The second component is stock options that have vested and are therefore *exercisable*, but that Musk has chosen not to exercise thus far. Should Musk need to increase his voting power to fend off a "takeover by dubious interests" (as he put it), he could immediately exercise these options, converting them to shares—and votes—in hand. The third component is a deduction for shares used as collateral for loans that could be called in at any time by the lenders.

As can be seen in Table 5, Musk's SBO as a percentage of Tesla's outstanding shares (%SBO) declined every year from 29.1 percent in 2011, the year after Tesla's IPO, to 20.8 percent in 2020, with a large drop of 4.5 percentages points from 2016 to 2017. His %SBO then increased 2.3 percentage points in 2021 and another 0.4 points in 2022 before declining again to 20.6 percent in 2023 and a record low of 20.5 percent in 2024—at which level about 84 percent of non-Musk votes was required to exceed the supermajority threshold.

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[216] Tesla, Amended and Restated Bylaws of Tesla Motors, Inc., (initially adopted on July 17, 2003), (amended and restated on December 16, 2009 and effective as of the closing of the corporation's initial public offering), (as amended and restated on June 6, 2012), p. 24.

[217] Ronald Orol, "How Elon Musk controls Tesla with only a minority ownership stake," *TheStreet*, April 23, 2018.

Table 5: Elon Musk's voting power from Tesla shares, 2011-2024

Year	Shares Beneficially Owned (SBO) (unadjusted for stock splits)	SBO as % of Tesla's outstanding shares	Percentage of SBO in hand	Percentage of SBO as exercisable options	Percentage of SBO reduced by collateral shares
2011	28,356,418	29.1	26.3	2.7	0.0
2012	31,466,379	28.9	24.9	4.0	0.0
2013	33,076,212	27.5	23.8	5.1	-1.4
2014	35,001,294	27.0	23.0	5.5	-1.4
2015	35,528,859	26.7	22.5	5.8	-1.6
2016	37,193,974	26.5	21.6	6.7	-1.8
2017	36,175,151	22.0	20.7	1.7	-0.4
2018	37,853,041	21.9	19.9	2.5	-0.5
2019	38,572,790	21.7	19.6	2.8	-0.6
2020	38,658,670	20.8	18.8	2.5	-0.6
2021	244,018,640	23.1	17.3	7.5	-1.7
2022	265,488,606	23.5	16.7	9.0	-2.1
2023	715,022,706	20.6	13.0	9.6	-2.0
2024	715,022,706	20.5	12.9	9.5	-1.9

Source: Calculations by authors, Tesla DEF 14A Proxy Statements, 2011-2024.

Eroding Musk's proportional voting power were, as shown in Table 6, a) shares issued to employees and directors, other than Musk, as stock-based pay, b) shares issued, other than to Musk, for cash to fund Tesla's operations, c) stock issues for converting preferred shares to common shares, d) warrants (non-employee options to buy common shares), and e) shares issued for acquisitions. Note that all the share counts in Table 6 and cited in the following discussion are adjusted to reflect Tesla's stock splits in August 2020 and August 2022.

When Tesla employees and directors, other than CEO Musk, received Tesla shares from stock-based pay, predominantly by the exercise of stock options, shareholding in Tesla was diluted annually by between 0.7 percentage points (in 2010 and 2023) and 3.6 percentage points (in 2013). In all, from 2010 through 2023, 599.3 million shares were issued to employees other than Musk, equal to 18.8 percent of Tesla's shares outstanding on March 31, 2024. Not including the (on average, five) highest-paid Tesla executives named each year in the company's proxy statements, Tesla employees realized gains from stock-based pay equal to $27.1 billion from 2010

through 2023. Over the same 14 years, the named executives (among whom non-executive directors are not included) had total realized gains from stock-based pay of $26.2 billion, with $24.8 billion going to Elon Musk.

Table 6: Dilution of Tesla shareholding by issue of shares (millions, adjusted for 2020 and 2022 stock splits), other than to Elon Musk, 2010-2023

	Millions of shares issued (not to Elon Musk)					Percent dilution		
Year	Stock-based pay	Share issues for cash	Preferred stock conversion	Settlement of warrants	Acquisi-tions	Stock-based pay	Share issues for cash	Preferred stock, warrants, and acquisitions
2010	10.7	243.6	686.4	6.7	0.0	0.7	17.0	48.5
2011	22.1	101.0	0.0	0.0	0.0	1.4	6.4	0.0
2012	25.8	118.9	0.0	0.0	0.0	1.5	6.9	0.0
2013	65.7	51.2	0.0	0.0	0.0	3.6	2.8	0.0
2014	39.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
2015	39.6	45.2	0.0	0.0	0.0	2.0	2.3	0.0
2016	65.8	118.7	0.0	0.0	142.8	2.7	4.9	5.9
2017	63.9	21.6	16.1	0.0	0.5	2.5	0.9	0.7
2018	53.5	0.0	3.6	0.0	0.0	2.1	0.0	0.1
2019	72.0	46.3	0.0	0.0	0.0	2.6	1.7	0.5
2020	55.0	101.0	0.0	0.0	0.0	1.9	3.5	0.2
2021	38.4	0.0	0.0	112.0	0.0	1.2	0.0	3.7
2022	27.0	0.0	0.0	37.0	0.0	0.9	0.0	1.2
2023	21.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0

Source: Tesla 10-K filings, 2010-2023, "Consolidated Statements of Redeemable Noncontrolling Interests and Equity"

In its initial public offering on NASDAQ on June 29, 2010, Tesla issued 178.2 million shares, representing 12.4 percent of Tesla's shares outstanding on December 31, 2010, and raising $226.1 million. At the same time, Tesla issued, as a private placement, 44.1 million shares to Toyota, raising $50 million. From 2010 through 2023, including the IPO, Tesla issued 847.6 million shares to raise cash for operations through both public offerings and private placements. These shares represented 28.2 percent of total shares outstanding on March 31, 2024, while the total amount of cash raised was $17.1 billion.

The conversion of preferred stock into 686.4 million common shares at the IPO on June 29, 2010, diluted common shareholding by 48.5 percent, but it did not result in any dilution of voting power because the preferred shares had the same proportional

voting power as the new common shares.[218] Tesla's all-stock acquisition of SolarCity in June 2016 diluted shareholding in that year by 5.9 percent and represented 4.5 percent of Tesla's shares outstanding on March 31, 2024. In 2021 and 2022, Tesla settled warrants connected with convertible debt issues, which diluted shareholding by 4.9 percent in those two years and represented 4.7 percent of Tesla shares outstanding on March 31, 2024.

All these different types of share issues diluted Elon Musk's voting power. To counter this erosion of his voting power, Musk needed to acquire new beneficially owned shares. One way to do so was by purchasing shares on the market or as private placements. From 2011 to 2013, he bought 38.0 million shares, equal to 2.1 percent of the shares outstanding at the end of 2015. Subsequently, from 2015 to 2020, he purchased 12.2 million shares, representing just 0.4 percent of shares outstanding on June 30, 2020. As Tesla's stock price rose, Musk was priced out of the market if he wanted to amass the huge quantity of shares, and their voting power, to offset the dilution that was occurring because of employee stock-based pay and fundraising from the stock market.

In 2009, with the company's IPO on the horizon, Musk understood that the most potent way to pad his share count, and voting power, was through stock-based pay. As CEO, he could have asked his board, which he chaired, to grant him *stock awards*, on which there would be no exercise price when, subject to any performance criteria that the board might choose to set, the awards would vest, at which point he would take possession of the shares. Or he could ask the board to grant him *stock options*, again with vesting subject to performance criteria if the board so chose, for which he would *not* have to take possession of the shares once they vested.

Instead, with stock options, he could wait until the most opportune time to exercise the options, right up to the end of their expiration date, ten years from the grant date. During the period between vesting and exercising of the options, he would not own the shares and their voting power, but the options would be, as we have already noted, *exercisable*. If Musk needed to have increased voting power in hand—say, to fight off a hostile takeover—he could exercise the options, borrowing money to pay the exercise price and selling a portion of the shares (or borrowing money) to pay his personal taxes on the realized gains.

[218] In May 2009, upon entering into its first strategic partnership, in this case with Germany-based Daimler, Tesla had converted $40 million in convertible debt, held by investors, into preferred stock. Prior to the Daimler investment, Tesla had raised a total of $200 million from venture capitalists, who held preferred stock. Mara Lemos Stein, "Tesla signs up Daimler and knocks on DOE's door," *Dow Jones News Service*, May 20, 2009.

Looking back to Table 5, Musk's %SBO *in hand* declined year after year, from 26.3 in 2011 to 12.9 percent in 2024. But this decline of %SBO in hand was offset to a large extent over the 14 years by Musk's accumulation of vested stock options that were *exercisable* at any moment that he might deem necessary—say, to fight off a hostile takeover by having the voting power in hand. The exception was the sharp drop in %SBO exercisable from 6.7 percent in 2016 to 1.7 percent in 2017, when, with the term of the stock options expiring in 2016, Musk decided to exercise stock options, granted in 2009.

From March 31, 2022, to March 31, 2023, %SBO in hand declined from 16.7 percent to 13.0 percent, largely because, between April and December of 2022, Musk sold 94.1 million of his shares valued at $28.7 billion to help fund his $44-billion purchase of Twitter.[219] The sale of Tesla shares to finance his acquisition of Twitter cost Musk 3.0 percentage points of %SBO. Meanwhile, the drop in %SBO in hand was partially offset by an increase of 0.6 percentage points in %SBO exercisable as tranches of shares in the 2018 option package continued to vest.

Musk's 2018 stock-option grant, therefore, is critical to restoring voting power that Musk lost by purchasing Twitter. With Musk's vested stock options from his 2018 stock-option grant voided, he stood to lose 7.1 percent of his voting power. As is well known, Musk only thought once when he made his rash bid for Twitter.[220] Given the importance that he places on control at Tesla, had he contemplated that in 2024 the Delaware Court of Chancery would rescind his 2018 option package, he might have thought twice about spending tens of billions of dollars to purchase another company. Note, moreover, that Musk's business with the Delaware court may not be over; at a hearing on August 2, 2024, Judge Kathaleen St. J. McCormick asked Tesla's lawyers whether there was ever a precedent for a company overruling a court decision by simply revoting on a transaction that the court had voided.[221]

As of this writing, the extent of Musk's voting influence to fend off a hostile takeover at Tesla remains an open question. As Tesla has become profitable in recent years, it has become a more attractive target for predatory value extractors, while, at the same time, giving Tesla the funds to avoid the need to raise cash by further public

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[219] Hyunjoo Jin and Chibuike Oguh, "Explainer: How Elon Musk funded the $4 billion Twitter deal," *Reuters*, October 28, 2022.

[220] Associated Press, "Timeline of billionaire Elon Musk's bid to control Twitter," *Associated Press*, October 28, 2022.

[221] Peter Eavis, "Delaware judge questions Tesla about vote on Elon Musk's Tesla pay," *New York Times*, August 2, 2024.

stock issues that would dilute Musk's voting power. If faced with a threat to his control, Musk might be tempted to use Tesla's profits to do stock buybacks, which would both appease the shareholder activists and, by taking shares off the market, increase his voting power.[222]

Potential challenges to Musk's strategic control

On January 24, in Tesla's Q4 2023 earnings call,[223] Musk expressed concern that, under his watch, Tesla could implement an innovation strategy, "creating an artificial intelligence and robotics juggernaut of truly immense capability and power", only to find himself voted out as CEO "by some sort of random shareholder advisory firm." He continued (with our editing of redundant verbiage):

> You know, we've had a lot of challenges with Institutional Shareholder Services, ISS—I call them ISIS—and Glass Lewis, you know, which there's a lot of activists that basically infiltrate those organizations and have, you know, strange ideas about what should be done. So, I want to have enough to be influential—like, if we could do dual-class stock, that would be ideal. I'm not looking for additional economics; I just want to be an effective steward of very powerful technology. And the reason I just sort of roughly picked approximately 25% was that that's not so much that I can control the company even if I go bonkers. And if I'm, like, mad, they can throw me out, but it's enough that I have a strong influence. That's what I'm aiming for is a strong influence but not control.

What is this system, apparently spearheaded by ISS and Glass Lewis, that has the power to mobilize shareholder votes against Musk and throw him out of office? We refer the reader to the book, *Predatory Value Extraction*, by William Lazonick and Jang-Sup Shin, in which they explain how, since the late 1980s, in the name of "maximizing shareholder value", institutional changes in corporate governance have transformed the relations between hedge-fund activists and corporate executives to prioritize value extraction over value creation.[224] The looting of the business

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[222] Sam L. Shead, "Tesla whale calls for $15 billion stock buyback after share price craters," *CNBC*, May 19, 2022; Jeremy Owens, "Elon Musk teases massive Tesla stock buyback as CFO trims forecast for annual deliveries and stock falls," *MarketWatch*, October 22, 2022.

[223] Motley Fool Transcribing, "Tesla (TLSA) Q4 2023 earnings call transcript," *The Motley Fool*, January 24, 2024.

[224] Lazonick and Shin, *Predatory Value Extraction*.

corporation via distributions to shareholders in the form of stock buybacks, in addition to dividend payments, became the norm in the United States.

From its adoption in November 1982, Securities and Exchange Commission (SEC) Rule 10b-18[225] has given those who exercise strategic control over corporate resource allocation a license to loot the corporate treasury by means of open-market share repurchases, aka stock buybacks.[226] Then, during the 1980s, the compensation of senior corporate executives with stock options gave them the incentive, as *value extracting insiders*, to participate in this looting process by executing buybacks. Meanwhile, large institutional shareholders became *value-extracting enablers* as their fund managers sought to exceed quarterly yield targets by placing a portion of their funds' financial assets with hedge funds *as value extracting outsiders*, who have an overwhelming penchant for stock buybacks.[227]

In 1988, the U.S. Department of Labor issued what has become known as the "Avon letter," which deemed it a fiduciary obligation for pension funds to vote the shares in their asset portfolios.[228] In 2003, a ruling by the SEC extended this fiduciary obligation to mutual funds, thus making it much easier for a hedge-fund activist such as Carl Icahn, Daniel Loeb, Nelson Peltz, or Paul Singer, holding only a small percentage of a company's shares outstanding purchased on the stock market, to line up a large block of proxy votes for board elections and thus pose a credible threat to incumbent management's strategic control.[229]

The activists can get help mobilizing proxy votes by soliciting the support of the two major proxy advisory services companies, ISS and Glass Lewis, which, subsequent to the 2003 SEC ruling, emerged, unregulated, to dominate this specialized segment of the "market for corporate control". The most important recommendations that the proxy advisors make to institutional shareholders concern candidates for election or re-election to the corporate board.[230]

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[225] William Lazonick and Ken Jacobson, "Letter to SEC: How Stock Buybacks Undermine Investment in Innovation for the Sake of Stock-Price Manipulation," *Institute for New Economic Thinking*, April 1, 2022.
[226] Lazonick, *Investing in Innovation.*
[227] Lazonick and Shin, *Predatory Value Extraction*, chs. 4-7.
[228] David G. Ball, "Where the Government Stands on Proxy Voting," *Financial Executive. 6, 4,* 1990: 31-36.
[229] Lazonick and Shin, *Predatory Value Extraction*, ch. 5.
[230] Ibid.

Meanwhile, in the 1990s, regulatory changes increased the tools available to hedge funds to attack incumbent corporate management, as well as the size of the "war chests" (to use Carl Icahn's term[231]) under hedge-fund management that finance the value-extracting campaigns. In 1992 and 1999, SEC amendments to its proxy regulations enabled hedge-fund managers to communicate freely among themselves and with corporate management concerning issues of corporate control. As a result, it became much easier for hedge funds to form de facto cartels—known as "wolf packs"[232]—for activist campaigns.

The National Securities Markets Improvement Act (NSMIA) of 1996 enabled hedge funds and private-equity funds to access a virtually unlimited number of institutional shareholder funds while continuing to avoid regulation under the 1940 Investment Company and Investment Advisers Acts.[233] As a result, assets under management by unregulated hedge funds (and private-equity funds) soared from the late 1990s, augmenting the financial power of hedge-fund activists to engage in predatory value extraction while giving fund managers of pensions and university endowments, among other institutional shareholders, stakes in activist campaigns in their quest for higher yields on their financial-security portfolios.

Each of these regulatory changes has contributed to an institutional environment that empowers financial predators to challenge executives' resource-allocation decisions, with devastating consequences for the U.S. economy. Consider the case of General Electric (GE), a once-iconic U.S. company that in 2011-2015 had been among the largest industrial share repurchasers, with $22.2 billion in stock buybacks (44 percent of net income) and $39.6 billion in dividends (another 79 percent of net income). On October 5, 2015, Nelson Peltz's Trian Partners disclosed that the hedge fund had purchased $2.5 billion of GE's stock—its largest ever stake in a company but only about 0.9 percent of GE's outstanding shares.[234]

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231 William Lazonick, Matt Hopkins, and Ken Jacobson, "What We Learn about Inequality from Carl Icahn's $2 Billion 'No Brainer'," *Institute for New Economic Thinking*, June 6, 2016.

232 John C. Coffee Jr. and Darius Palia, "The Wolf at the Door: The Impact of Hedge Fund Activism on Corporate Governance," *Journal of Corporation Law*, 41, 3, 2016: 545-603.

233 U.S. Congress, "National Securities Markets Improvement Act of 1996," Public Law 104-190, October 11, 1996.

234 William Lazonick and Matt Hopkins, "General Electric in the Grip of Predatory Value Extractors," Academic-Industry Research Network unpublished note, April 4, 2021, as a contribution to Nick Juravich and Arthur C. Wheaton, "Building a Sustainable Future for General Electric in Schenectady, New York, and Lynn, Massachusetts," School of Industrial and Labor Relations, Cornell University, and Labor Resource Center, UMass Boston, November 2021, posted at IUE-CWA Local 201.

As a hedge-fund activist, Peltz epitomized the value-extracting outsider. Not one cent of Trian's $2.5 billion stake flowed into GE's coffers for investment in productive capabilities or any other purpose. The stated view of Peltz's activist campaign was to pressure GE to increase its distributions to shareholders to boost its stock price, with a view to Trian selling its shares for a $2 billion profit in just two years.[235]

Earlier in 2015, Trian had mounted a proxy fight at DuPont, with the backing of ISS, Glass Lewis, and the California State Teachers' Retirement System. In the election of board members in May, incumbent management prevailed over Trian.[236] Nevertheless, DuPont CEO Ellen Kullman warned that, as a result of the influence that Trian had gained during the proxy battle, Peltz would seek to establish a "shadow management" within DuPont to achieve his value-extracting objectives. Sure enough, on October 5, 2015—the very same day that Trian announced its attack on GE—Kullman resigned as DuPont CEO, with Trian-friendly board member Edward Breen taking her place.[237]

When Peltz turned his activist attack on GE, no proxy contest was required. GE CEO Jeffrey Immelt and CFO Jeffrey Bornstein were quoted by the *Wall Street Journal* as being "completely aligned on the levers" suggested by Trian to get GE "from point A to point B". Referring to Trian's proposal to jack up GE's stock price by doing large-scale stock buybacks, Immelt stated: "The repurchase opportunity is right in front of us."[238]

In 2016, GE distributed $8.8 billion in dividends, just a shade under 100 percent of net income, plus $22.6 billion in buybacks, 256 percent of net income. In the first quarter of 2017, however, Peltz let it be known that he wanted CEO Immelt out,[239] and by June Immelt announced that he was stepping down.[240] In October 2017, Peltz

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235 Lewis Krauskopf, "Nelson Peltz's Trian takes $2.5 billion stake in General Electric," *Reuters*, October 5, 2015.

236 Tom Hals, "DuPont wins board proxy fight against activist investor Peltz," *Reuters*, May 13, 2015.

237 Jacob Bunge, "DuPont CEO Ellen Kullman steps down," *Wall Street Journal*, October 5, 2015.

238 David Benoit and Ted Mann, "Activist firm Trian takes $2.5 billion stake in General Electric," *MarketWatch*, October 5, 2015.

239 Thomas Black, Beth Jinks, and Rick Clough, "Peltz-Immelt showdown heats up as GE rushes to boost profits," *Bloomberg*, March 23, 2017.

240 Jena McGregor and Thomas Heath, "GE's CEO Jeffrey Immelt to step down after 16 years," *Washington Post*, June 12, 2017.

got GE to put his son-in-law and Trian partner Edward Garden on the company's board.[241]

The adverse consequences for GE were drastic. From 2016 to 2021, GE's revenues declined from $119.7 billion to $74.2 billion, and its worldwide employment from 295,000 to 168,000. Over the years 2017-2021, the company's losses totaled $36.8 billion. In November 2021, GE announced that it would break itself into three companies, engaged in energy, medical equipment, and aviation—the industrial activities on which, beginning in the last decades of the 19th century, the company had been built.[242] While Peltz had sold chunks of GE stock at different points in time, the company's shares still represented about five percent of Trian's portfolio, and Peltz and Garden pushed for the GE break up as a way of "creating" shareholder value for themselves.[243]

Many of the largest and most successful U.S. business corporations do massive amounts of stock buybacks to keep hedge-fund activists at bay.[244] Take, for example, the case of Apple, which from October 2012 through June 2024 spent *$701 billion* on buybacks (91 percent of net income) in addition to paying out $156 billion in dividends (another 20 percent of net income). Apple could have used a fraction of that vast sum wasted on buybacks to invest in, and exercise control over, component technologies, including chips and batteries, that are crucial to the performance of Apple's final products—and are of critical importance in U.S. geopolitical relations.

Notwithstanding its extravagant buybacks, Apple was among the companies that lobbied the U.S. government to pass the CHIPS and Science Act of 2022, which provides $52.7 billion in government subsidies to bring semiconductor manufacturing back to the United States.[245] Yet, especially after the launch of its iPhone in 2007, Apple could have made a direct investment in a state-of-the-art semiconductor fab in the United States. Instead, with the iPhone's need for ever

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241 Thomas Gryta, David Benoit, and Joann S. Lublin, "GE gives activist Trian a seat on the board," *Wall Street Journal*, October 9, 2017.

242 Jesse Pound, "GE to break up into 3 companies, focusing on aviation, health care, and energy," *CNBC*, November 9, 2021.

243 John Vincent, "Tracking Nelson Peltz's Trian Fund Management Portfolio—Q42021," *Seeking Alpha*, February 20, 2022.

244 Lazonick, *Investing in Innovation.*

245 William Lazonick and Matt Hopkins, "How Intel Financialized and Lost Leadership in Semiconductor Fabrication," *Institute for New Economic Thinking*, July 7, 2021; The White House, "Fact Sheet: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China," *Briefing Room*, August 9, 2022.

more sophisticated microprocessors, Apple outsourced its high-end chip fabrication first to Samsung Electronics and then, from 2012 when Samsung had become Apple's main competitor in smartphones, Taiwan Semiconductor Manufacturing Company. The Apple contracts helped both these companies become world leaders in advanced chip manufacturing.[246]

Apple could have also made direct investments in rechargeable battery manufacturing in the United States. Instead, from 2009, Apple outsourced the manufacture of rechargeable batteries for its devices to Samsung Electronics, and from 2012 switched to China-based Amperex Technology Limited (ATL).[247] The previous year, ATL had spun off its EV battery division as Contemporary Amperex Technology Limited (CATL), which is now—aided by a deal with Tesla when it set up operations in China—the world's leading producer of EV batteries.[248]

As a result of its practice of outsourcing key components, Apple appears to have lost the capability to make direct investments in critical technologies when needed. Recently, the company shut down its multibillion-dollar effort to develop autonomous electric vehicles,[249] and it is a laggard in AI.[250] Meanwhile, to repeat, from October 2012 through June 2024, Apple wasted $701 billion—an average of $60 billion per year—repurchasing its own shares. Why? The only plausible explanation for the decisions by Apple CEO Timothy Cook and his board (which includes Albert Gore Jr.) to squander the company's cash on buybacks is that they have been seeking to appease hedge-fund activists for the sake of keeping their jobs.[251]

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[246] William Lazonick and Matt Hopkins, "Why the CHIPS Are Down: Stock Buybacks and Subsidies in the U.S. Semiconductor Industry," *Institute for New Economic Thinking* Working Paper No. 165, November 1, 2021.

[247] Anon., "China firms benefit from Apple, Samsung competition," *SinoCast Computers & Electronics Beat*, November 27, 2012; Kim Young-gyo, "Apple turns to Chinese makers for its battery supply," *Yonhap English News*, November 29, 2012.

[248] Anon., "The battery billionaire who's key to Tesla's future in China," *Bloomberg News*, July 18, 2020.

[249] Brian X. Chen and Tripp Mickle, "Behind Apple's doomed car project: False starts and wrong turns," *New York Times*, February 28, 2024.

[250] Mark Sullivan, "Apple doesn't like to be called an AI laggard," *Fast Company*, August3, 2023.

[251] See Lazonick, et al., "What We Learn about Inequality"; William Lazonick, "Apple's 'Capital Return' Program: Where Are the Patient Capitalists?" *Institute for New Economic Thinking*, November 13, 2018; Lazonick and Hopkins, "Why the CHIPS Are Down."

Does Cook's strategy of looting Apple's corporate treasury to insulate himself from hedge-fund activism foreshadow Musk's fate at Tesla? In assessing his own vulnerability to an attack by a hedge-fund activist, Musk is undoubtedly watching the moves of Jeffrey Bezos, founder and chair of Amazon, who handed over the CEO position to Andrew Jassy in July 2021. Launched in 1994 with its IPO in 1997, Amazon, like Tesla, has one class of common shares with one vote each. In 1998, Bezos held 41.0 percent of Amazon's shares outstanding, but that voting power declined to 20.7 percent in 2010 and 10.8 percent in 2024, diluted by share issues for stock-based pay and acquisitions as well as by share sales by Bezos to fund his rocket company Blue Origin and opulent lifestyle. When Bezos and his wife MacKenzie Scott divorced in 2019, he retained the voting power of the 25 percent of his shareholdings in Amazon that she received.[252]

Prior to 2022, Amazon, like Tesla, had done no distributions to shareholders, other than some share repurchases done between 2006 and 2012 as part of its plan to give one or two shares annually to low-paid warehouse and delivery employees.[253] In early 2022, however, Amazon learned that hedge-fund activist Daniel Loeb was amassing shares in the company. In response, from January through May 2022, Amazon repurchased $6.0 billion in shares to boost its stock price and appease Loeb.[254] In February 2022, Amazon announced a 20:1 stock split, designed to render a proxy attack more difficult for a hedge-fund activist such as Loeb by making its shares more affordable to small (retail) stock traders.[255]

For the same purpose, Tesla did a 5:1 stock split in August 2020 and a 3:1 stock split in August 2022.[256] As part of his campaign to save his 2018 stock option package, Musk offered a prize tour of the Tesla factory in Austin, Texas with chief designer Franz von Holzhausen to fifteen lucky shareholders.[257] As votes were being cast, Musk X-posted that 90 percent of retail shareholders were in favor of re-approving his stock options.[258] Following shareholder approval, Musk posted, "hot damn, I love

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252 Ban Fox Rubin, "Jeff Bezos' $150 billion divorce: What you need to know," *CNET*, April 4, 2019.

253 William Lazonick, "The secret of Amazon's success," *New York Times*, November 19, 2018.

254 Annie Palmer, "Amazon announces 20-for-1 stock split, $10 billion buyback," *CNBC*, March 9, 2022.

255 Fitri Wulandari, "Who owns Amazon: 10 major AMZN shareholders in 2024," *Techopedia*, January 29,2024.

256 Tesla, "Tesla announces a three-for-one stock split," *Tesla press release*, August 5, 2022.

257 Simon Alvarez, "Tesla giga Texas tour with Musk, von Holzhausen offered for luck TSLA shareholders," *Teslarati*, May 28, 2024.

258 @elonmusk, *X post*, June 8, 2024.

you guys."[259] Retail shareholders at companies like Tesla can provide an important source of votes in the battle for corporate control as U.S. stock exchanges have become more powerful value-extracting institutions.[260]

Musk's options for maintaining strategic control

You can bet that when Elon Musk makes a statement such as "there's a lot of activists that basically infiltrate those organizations [i.e., ISS and Glass Lewis] and have, you know, strange ideas about what should be done", he has in mind the scenarios that have played out at companies such as DuPont, GE, Apple, and Amazon, along with many others. His defense, as we have seen, is to amass as much voting power as possible, with his impetuosity in acquiring Twitter and (as it turned out) overreach in granting himself the 2018 stock-option package creating some self-imposed bumps in the road.

There are two other routes that Musk could have followed in his quest for unfettered strategic control at Tesla: issuing dual-class shares and taking the company private. For the former, he could look to the cases of Google and Facebook; for the latter to the case of Dell Computer. But exercising these strategic-control options would have been, for Tesla, far easier said than done.

In his X-post of January 15, 2024, quoted above, Musk lamented:

> I would be fine with a dual class voting structure to achieve this, but am told it is impossible to achieve post-IPO in Delaware.[261]

In its 2004 IPO, Google issued dual-class shares, with Class A shares, publicly traded on NASDAQ, having one vote each and Class B shares, closely held by Google co-founders Sergey Brin and Larry Page, with 10 votes each. Google's distributions of Class A shares to a broad base of its employees as stock-based compensation, however, eroded the majority voting power of Brin and Page, pushing it down toward 50 percent. In 2013, therefore, the company issued Class C shares with no votes, also publicly traded on NASDAQ, with holders of Class A shares receiving Class C shares as a stock dividend. In 2015, the company was renamed Alphabet, with Google as an operating division. By issuing Class C nonvoting shares

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[259] Aimee Picchi, "Tesla shareholders approve $46 billion pay package for CEO Elon Musk," *CBS News*, August 2, 2024.
[260] Lazonick and Shin, *Predatory Value Extraction*.
[261] @elonmusk, *X post*, January 15, 2024.

to employees in their compensation packages, Brin and Page have been able to maintain majority voting control of Alphabet. On April 9, 2024, their combined voting power was 51.7 percent.[262]

A condition for the creation of Class C shares imposed by Class A shareholders through litigation was that the company would be obliged to maintain the market value of C shares within one percent of the value of A shares or otherwise pay C shareholders the difference in cash or stock.[263] A portion of the $240 billion in buybacks of Class C shares that Alphabet did from the fourth quarter of 2015 through the second quarter of 2024 was to manage this price differential by manipulating the price of C shares.

When Facebook did its IPO in 2012, it also issued dual-class shares, with Class B shares having ten times the votes of the publicly traded Class A shares. As of April 1, 2024, Facebook (now Meta) founder and CEO Mark Zuckerberg owned 99.7 percent of the Class B shares, with 61.0 percent of total voting power. In 2013, Class B shares had possessed 67.2 percent of the voting power.[264] Thus far, unlike Google, the issue of Class A shares for employee compensation and acquisitions has not pushed Class B share voting power anywhere near 50 percent.

Why didn't Tesla issue dual-class shares when it did its IPO in 2010? When Google did its IPO in 2004, it was a profitable company with $3.2 billion in revenues, and when Facebook did its IPO in 2012, it was also profitable with $5.1 billion in revenues. By virtue of their social media products, both companies were already household names. Moreover, as software companies, their need to raise cash from the stock market for capital expenditures was much less than for a consumer-durable mass-production company such as Tesla. Their founders could do successful IPOs, even though ordinary shareholders knew that the existence of dual-class shares would enable the founders to maintain majority voting power.

In Tesla's case, the stock market would likely not have been willing to absorb an initial public offering of a loss-making company with only $117 million in revenues, ceding voting control to its founder/CEO through dual-class shares. If Tesla insiders had been willing and able to wait another decade or so to do Tesla's IPO, Musk may have been able to realize his dream of dual-class shares. Instead, Tesla's listing on the stock market without dual-class shares makes Musk vulnerable to a hedge-fund

[262] Alphabet DEF 14A 2024 Proxy Statement, p. 38.
[263] Tom Hals, "Google settlement clears way for news Class C stock," *Reuters,* June 17, 2013.
[264] Meta DEF 14A 2024 Proxy Statement, p. 78.

activist campaign. Note, however, that just prior to its IPO, Tesla was able to amend its certificate of incorporation to require a supermajority of 66.67% of the votes of shares outstanding to, among other things, challenge Musk's control.

As a publicly listed company, Tesla has been attacked by hedge-fund short sellers, bent on driving down the company's stock price for their own profit. In 2018, Tesla was among the most shorted stocks ever.[265] In frustration, at 12:48 PM on August 7, 2018, Musk tweeted "Am considering taking Tesla private at $420. Funding secured."[266] As a consequence of this tweet, the SEC charged Musk with securities fraud,[267] and forced him to relinquish his chairmanship of Tesla for three years (thus far, Musk has not reclaimed it).[268]

With that nine-word tweet, Musk effectively blew any chance he may have had to take Tesla private. He may have done better if he had consulted with Michael Dell about how to delist a company from the stock market for the purpose of securing control as a condition for investing in innovation—and then how to put it back on the stock market with dual-class shares.

Dell had founded the eponymous computer company in 1984 while he was an 18-year-old student at the University of Texas. A pioneer in selling computers over the Internet from 1996, by the first quarter of 2001 Dell Computer had a 12.8 percent share of the global PC market, surpassing Compaq as number one.[269] Dell has been chairman of the company throughout its history and CEO except for 2004-2007.[270] By that time, PCs had become a commodity business, and the company was doing large-scale buybacks—$27.6 billion, or 101 percent of profits, for the decade 2003-2012—to prop up its stock price. In addition, Dell paid its first dividend in 2012.

Rather than distribute corporate cash to shareholders, Michael Dell wanted to reinvest in more sophisticated technologies. To do so, he partnered with private-equity firm Silver Lake, to take the company off the stock market with a $24.9 billion tender offer, despite the opposition of Carl Icahn, who had snapped up six percent

[265] Pierson, "Tesla: Most shorted stock ever?".
[266] @elonmusk, *X post*, August 7, 2018.
[267] U.S. Securities and Exchange Commission, "Elon Musk charged with securities fraud for misleading tweets," *SEC press release*, September 27, 2018.
[268] U.S. Securities and Exchange Commission, "Elon Musk settles SEC fraud charges".
[269] Staff and wire reports, "Dell takes top spot in PC market," *CNN*, April 23, 2001.
[270] Damon Darlin, "Dell chief is replaced by founder," *New York Times*, February 1, 2007.

of Dell Computer's shares.[271] As a privately held company, in 2016 Dell spent $67 billion to acquire EMC, the leading data storage company, which was also majority owner of VMware, a cloud computing and virtualization company.[272] With these acquisitions, Dell renamed the company he had founded 36 years earlier Dell Technologies.[273]

In 2018, Dell Technologies listed its Class C shares on the New York Stock Exchange,[274] and, with Michael Dell in control, has become a far stronger company, technologically and economically, than it had been before going private to reinvest in its growth.[275] Dell Technologies has treble-class shares, with, as of May 1, 2024, Michael Dell possessing 69.3 percent of the voting power and Silver Lake Partners 17.4 percent. That is a control outcome about which, for the foreseeable future, Musk can only fantasize.

Should Musk retain strategic control?

In 2024, is Elon Musk the right person to be CEO of the world's leading EV company? We respond to this question, not as shareholders or employees, but rather as academic researchers concerned about the impact of his exercise of strategic control on Tesla's ongoing contribution to the global EV transition. More pointedly, from the perspective of innovative enterprise,[276] we ask whether and how Musk might abuse his power of strategic control.

There is no question that Musk has made a positive impact on the EV transition thus far, playing critical roles as both financial investor and strategic decision maker in the emergence of Tesla as world leader in the development, manufacture, and delivery of EVs. Musk has carried out Tesla's original "master plan" to produce a succession of high-quality and increasingly affordable EVs. His hands-on management style and presence on the shop floor have been important at crucial points in the development of the vehicles and the implementation of mass production. With Musk serving as chairman and CEO, Tesla survived its transition from startup to going concern, becoming, with its third-generation EVs, Model 3 and

[271] Antoine Gara, "Deal of the century: How Michael Dell turned his declining PC business into a $40 billion windfall," *Forbes,* August 3, 2021.
[272] Jamie McGurk, Stephen McDermid, Vishal Amin, and Irvin Chan, "Making sense of the Dell-EMC-VMware deal," *Forbes*, October 27, 2015.
[273] "Why Dell has changed its name to Dell Technologies," *PCR*, May 3, 2016.
[274] Reuters, "Dell returns to public markets after 6 years," *VentureBeat*, December 28, 2018.
[275] Gara, "Deal of the century".
[276] Lazonick, "The Theory of Innovative Enterprise".

Model Y, the world leader in battery electric vehicles. In overseeing these investments, Musk himself had his own "skin in the game" to the tune of $291.2 million.

Under Musk's strategic control, Tesla recognized early on the critical need to invest in and deploy a coast-to-coast rapid charging network in the United States, which it subsequently expanded globally. As the first foreign-owned car company permitted to set up a wholly owned manufacturing plant in China, Tesla's entry into the world's largest car market helped to accelerate the EV transition there. Tesla's investment in manufacturing in Germany is helping to do the same in Europe. In collaboration with Japan-based Panasonic and China-based CATL, Tesla contracts have enabled the manufacture of high-quality EV batteries at lower costs. Under Musk's leadership, Tesla can claim credit for pioneering standard features in today's EVs such as "over the air" software updates, rapid charging, large in-car displays, "self-driving" capabilities, and batteries that can power a car for several hundred miles on a single charge.

The future, however, may look very different than the past. There have been many examples of actions that Musk has taken that call into question his commitment to maintaining Tesla as an innovative enterprise. One is his decision to hold, simultaneously, while Tesla CEO, the position of CEO at two privately held companies that he controls, SpaceX, and x.AI.[277] This dispersion of his attention and energy may distract him from the challenge of making decisions that can keep Tesla at the leading edge of innovation.

Musk's multi-CEO status can result in conflicts of interest that may not be resolved in Tesla's favor. An example is the diversion of Nvidia AI chips to x.AI that were supposed to go to Tesla.[278] Musk now faces a lawsuit from Tesla shareholders who claim that "Musk—CEO, controller, director, and 'Technoking' of Tesla—started X.AI Corp. ('xAI'), a separate AI company, began diverting scarce talent and resources from Tesla to xAI, and raised billions of dollars for xAI while touting xAI's access to Tesla's AI-related data."[279]

The most serious distraction thus far, however, has been Musk's acquisition of Twitter in October 2022. In acquiring Twitter, Musk sold Tesla shares worth $28.7

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[277] Dana Hull and Kurt Wagner, "Elon's orbit," *Bloomberg*, May 29, 2024.

[278] Lora Kolodny, "Elon Musk ordered Nvidia to ship thousands of AI chips reserved for Tesla to X and xAI," *CNBC*, June 4, 2024.

[279] Andrew J. Hawkins, "Tesla investors sue Elon Muck for launching a rival AI company, *The Verge*, June 13, 2024.

billion, reducing his Tesla voting power by 3.5 percentage points. Having taken strategic control of Twitter, Musk spent his first year laying off about 80 percent of its workforce.[280] He has thus far diminished, rather than built up, the value of the company. Under Musk's strategic control, X, as he renamed Twitter, has seen its value fall from the purchase price of $44 billion to an estimated $12.5 billion.[281]

As Musk focused on X, Tesla began showing signs of weakness, with declines in sales and profits recorded in the first quarter of 2024. In response to Tesla's sagging numbers, Musk announced mass layoffs—more than 10 percent of the 140,000-person workforce.[282] Musk had wanted to cut up to 20 percent, and as of June 2024 about 19,500 people (about 14 percent) have reportedly been given the pink slip.[283] Several of Tesla's top executives and managers have either left or have been fired.

After Tesla's senior director of EV charging Rebecca Tinucci pushed back on Musk's request to lay off a large proportion of her unit's highly successful workforce,[284] Musk responded by firing the entire supercharger team.[285] This "bonkers" move, to use Musk's own term, would seem to be grounds for throwing the self-anointed "Technoking" out.[286]

Investment in a supercharger network has been, and remains, a key dimension of Tesla's innovation strategy, and, at this stage of the EV transition, particularly in the United States, is critical to convincing potential buyers with "range anxiety" that they should purchase a battery EV—the only type of car that Tesla produces and

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[280] Matthew Loh, "Elon Musk says laying off 80% of Twitter's staff was 'painful' and 'one of the hardest things' he's had to do as the platform's boss," *Business Insider*, April 12, 2023.

[281] Adam Gabbatt, "Value of X has fallen 71% since purchase by Musk and name change from Twitter," *Guardian*, January 2, 2024.

[282] Jack Ewing, "Tesla will lay off more than 10% of workers," *New York Times*, April 15, 2024.

[283] Lora Kolodny, "Tesla internal data shows company has slashed at least 14% of workforce this year," *CNBC*, June 21, 2024; William Gavin, "Elon Musk wanted to lay off 20% of Tesla's workforce, report says," *Quartz,* April 22, 2024; Lora Kolodny, "As Tesla layoffs continue, here are 600 jobs the company cut in California," *CNBC*, May 17, 2024; Dallas Gagnon, "Tesla to lay off more than 7,000 workers in the US through August," *MassLive*, May 20, 2024.

[284] Andrew J. Hawkins, "Tesla Supercharger chief was fired because she challenged Musk," *The Verge*, May 15, 2024.

[285] Chris Kirkham, Hyunjoo Jin, and Adhirup Roy, "The inside story of Elon Musk's mass firings of Tesla Supercharger staff," *Reuters,* May 15, 2024; Andrew Evers, Jeniece Pettitt, Lisa Setyon, Lora Kolodny, "How Tesla may have just killed it most important product—its Superchargers," *CNBC*, May 14, 2024.

[286] Sean Burch, "Elon Musk anointed himself 'Technoking of Tesla' in cheeky SEC filing," *The Wrap*, March 15, 2021.

sells. A certain amount of impetuosity might contribute to the creative process when a company is a crazy startup with a few hundred employees, but at a large company such as Tesla, which has had over 140,000 people on its payroll, Musk's impetuosity, and its tacit approval by his enablers, can result in a failure of strategic control. Indeed, in a campaign event with Donald Trump on X on August 12, 2024,[287] Musk seemed to take pleasure in having the former president of the United States refer to him as the "greatest cutter", for his willingness to engage in mass layoffs at Twitter and Tesla without concern for the affected employees.[288]

Narcissism can be destructive as well. As we have seen, Musk has stated that he will not invest in Tesla's AI and robotics capability if, through the proxy-voting system, he can be ousted as Tesla's CEO. Even with the 2018 option package in force, Musk's 20-percent voting power leaves him insecure. Moreover, the Delaware court may uphold recission of his 2018 option package, which would reduce his voting power to a far more tenuous 13 percent.[289]

Nevertheless, what Musk and his Tesla board have learned from the option-package vote on June 13 is that the vast majority of the holders of the company's shares, not including those owned by Musk himself and his brother Kimbal, will support him—despite the contrary recommendations of ISS and Glass Lewis. This demonstration of loyalty should give hedge-fund activists—whom Musk rightly describes as "dubious interests"—pause in mounting a proxy contest. Then again, to keep the wolves at the door, Musk may take a cue from Apple CEO Cook and his board, and begin doing billions of dollars in stock buybacks, looting the treasury of Tesla for the sake of retaining his control.

What will Musk actually do? Will he allocate Tesla's resources for the sake of an innovation strategy that can keep Tesla at the forefront of the EV transition? Or will he make good on his only lightly veiled threat to sabotage Tesla's future to discourage a challenge to his strategic control by hedge-fund activists?

This conundrum speaks volumes about the perilous system of corporate governance that, in the grip of shareholder primacy, has caused the United States to lose global

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[287] Richard Cowan and Andy Sullivan, "Rambling Trump, Musk interview marred by tech issues," *Reuters*, August 12, 2024.

[288] Les Leopold, "Will the Democrats Listen to Shawn Fain?" *Wall Street's War of Workers*, August 29, 2024.

[289] Hyunjoo Jin, Ross Kerber, and Tom Hals, "Tesla plans to leverage Elon Musk's big pay win in Delaware court battle," *Reuters*, June 14, 2024.

leadership in critical technologies while feeding massive income inequality.[290] A CEO of a major industrial corporation must be focused on investment in innovation, for which the CEO must have the power to exercise strategic control. The CEO's motivation, however, cannot be control for its own sake but rather control as a social condition for investing in innovation.

It is not lost on us that Musk's stock options aggravate the inequality present both within Tesla and, indeed, on the planet Earth. His willingness to order mass firings, even to the detriment of the productive performance of the companies that he controls, exhibits sociopathic behavior. There is clearcut hypocrisy in Musk's over-the-top support for a U.S. presidential candidate who, as *Time* puts it, "keeps talking about slamming the brakes on a transition to EVs."[291] Perhaps it is because Musk's obsession with control over Tesla for its own sake seems to supersede his commitment to the EV transition. Notwithstanding Musk's past contributions to that transition, his control over Tesla at this juncture appears to be more a problem than a solution.

Given his bully pulpit as Tesla CEO, however, we do have one suggestion of a way in which he can help maintain Tesla as a driving force in the EV transition. If Elon Musk feels that the prevailing proxy-voting system and hedge-fund activism are compromising his power to allocate Tesla's resources to its innovation strategy, he might consider joining a movement to rid the U.S. industrial economy of its greatest disease: predatory value extraction.[292] Rather than blame the Securities and Exchange Commission for taking action against him for potential securities fraud, Musk could be using his influential position, and iconoclastic attitude, to push for fundamental change in a system of corporate governance that has become deeply corrupt.

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290 William Lazonick and Mustafa Erdem Sakinç, "Make Passengers Safer? Boeing Just Made Shareholders Richer," *American Prospect*, May 31, 2019, Lazonick and Hopkins, "How Intel Financialized"; Lazonick and Hopkins, "Why the CHIPS Are Down"; Lazonick, *Investing in Innovation*; Marie Carpenter and William Lazonick, "Losing Out in Critical Technologies: Cisco Systems and Financialization," *Institute for New Economic Thinking*, February 28, 2023; Hopkins and Lazonick, "How GM's $10-Billion Buyback".

291 Philip Elliott, "Trump is harnessing voter anxiety about electric vehicles," *Time*, June 17, 2024. See also Pras Subramanian, "'You can't just go to electric': Trump sounds off on EV transition as automakers warn on demand," *Yahoo!Finance*, March 11, 2024; Allan Smith, "With violent rhetoric, Trump fights electric vehicles to defeat Biden in Michigan," *NBC News*, April 9, 2024; Coral Davenport and Jack Ewing, "Can Trump really slam the brakes on electric vehicles?" *New York Times*, May 27, 2024.

292 Lazonick and Shin, *Predatory Value Extraction*.

That corruption includes the sham of the corporate board as a monitor of senior-management decision-making. Just as Musk uses stock-option grants to increase his voting control of Tesla, he also uses stock-option grants to ensure sycophancy of his board of directors (Table 7). In her Delaware court post-trial opinion, Judge McCormick notes the enormous gains reaped by Robyn Denholm as Tesla board chairwoman:

> Denholm ultimately received $280 million through sales in 2021 and 2022 of just some of the Tesla options she received as part of her director compensation. She described this transaction as "life-changing". Denholm testified that between 2017 and 2019, she received approximately $3 million per year in her non-Tesla position.[293]

Table 7: "Life Changing" director compensation at Tesla

Director	Years as director	Total direct compensation, $m	% total direct compensation from stock options	Potential realized gains, $m, as of 8/12/2024
Robyn Denholm	2014-2024	352.933	99.9	285
Brad Buss	2010-2019	24.624	98.7	*
Ira Ehrenpreis	2010-2023	396.231	99.9	195
James Murdoch	2016-2024	56.385	99.8	173
Linda Johnson Rice	2016-2019	0.135	49.8	*
Antonio Gracias	2010-2021	256.584	99.8	*
Total, six directors		1,086.893	91.3	

Notes: "Potential" realized gains is based on Tesla's average adjusted closing stock price from January 1, 2024, to August 12, 2024.
* Buss left the board in 2019, Rice in 2019, and Gracias in 2021.
Source: Tesla DEF 14A proxy filings, various years. Tesla Form 4 insider trades.

Indeed, by our calculations (see Table 7), since 2014, Denholm has reaped realized gains of $353 million when she has exercised stock options received as a Tesla director. On August 12, 2024, moreover, she possessed unexercised options on which, if exercised at average stock prices in 2024 up to that date, she could have reaped an additional $285 million. Among the other directors who approved Musk's 2018 option package, Ira Ehrenpreis has, since 2010, realized gains of $396 million

[293] Delaware Court of Chancery, "Post-Trial Opinion," pp. 24-25.

on the director options that he has exercised, with another approximately $195 million in options available to exercise. James Murdoch, who has been a Tesla director since 2016, has reaped $56 million from stock options so far, with $173 million in unexercised options remaining.

If a director is dropped, he or she loses access to already granted stock options that are either unvested or underwater (i.e., exercise price less than market price). For example, Linda Johnson Rice was on the Tesla board from 2016 to 2019, during which time her realized gains from stock options were $135,000, about equal to the cash stipend that she received as a director over these four years. If she had still been on the board in 2021, when Tesla's stock price peaked, the options that she had to leave on the table in 2019 could have fetched $173 million in realized gains.

The point is that, with director remuneration on this scale, there can be no such thing as an independent director. Should Musk abuse his position of strategic control, his board members would probably not recognize it, let alone take action to eliminate it. Especially in the era of maximizing shareholder value, the rewards for being a sycophantic director are simply too immense.

Meanwhile, at Tesla, as at almost all other major corporations based in the United States, there is no place for directors who represent the interests of employees and taxpayers—stakeholders who, as a rule, make far more significant contributions to corporate value creation than the public shareholders in whose name a company like Tesla is ostensibly run. For the sake of sustainable prosperity in the United States, fundamental corporate-governance reform should be on the policy agenda.[294] In any event, for anyone concerned with the EV transition, the critical question, which requires close attention, is how Elon Musk will use, or abuse, his strategic control at Tesla.

[294] Lazonick, *Investing in Innovation*.

References:

@elonmusk, *X post*, August 7, 2018.

@elonmusk, *X post*, January 15, 2024.

@elonmusk, *X post*, June 8, 2024.

@Tesla, *X post*, August 10, 2018.

Alphabet DEF 14A 2024 Proxy Statement.

Alvarez, Simon, "Tesla becomes China's most subsidized EV maker by receiving $325M in 2020," *Teslarati*, September 9, 2021.

Alvarez, Simon, "Tesla giga Texas tour with Musk, von Holzhausen offered for luck TSLA shareholders," *Teslarati*, May 28, 2024.

Andrabi, Saima, "Top 10 richest persons in the world. Elon Musk on top. Check the full list here," *The Quint World*, June 3, 2024.

Anon., "Video: The Tesla Model S is our top-scoring car," *Consumer Reports*, May 2013.

Anon., "China firms benefit from Apple, Samsung competition," *SinoCast Computers & Electronics Beat*, November 27, 2012.

Anon., "In search of the perfect battery," *Economist*, March 8, 2008.

Anon., "The battery billionaire who's key to Tesla's future in China," *Bloomberg News*, July 18, 2020.

Anon., "Why Dell has changed its name to Dell Technologies," *PCR*, May 3, 2016.

Associated Press, "Timeline of billionaire Elon Musk's bid to control Twitter," *Associated Press*, October 28, 2022.

Baer, Drake, "The making of Tesla: Invention, betrayal, and the birth of the Roadster," *Business Insider*, November 11, 2014.

Baker, David R., "Tesla paid only $42 million for NUMMI plant," *SFGate*, May 28, 2010.

Ball, David G., "Where the Government Stands on Proxy Voting," *Financial Executive. 6, 4,* 1990: 31-36.

Bauer, Pat, "Zip2," *Britannica Money*, August 17, 2024.

Bellan, Rebecca, "Tesla expands non-Tesla Supercharger access to China," *TechCrunch*, April 25, 2023.

Benoit, David, and Ted Mann, "Activist firm Trian takes $2.5 billion stake in General Electric," *MarketWatch,* October 5, 2015.

Berg, Nick, "World's best-selling car Is the Tesla Model Y," *Hagerty*, January 26, 2024,

Bhutada, Govind, "Mapped: EV battery manufacturing capacity, by region," *Visual Capitalist*, February 28, 2022.

Bhutada, Govind, "The six major types of lithium-ion batteries: A visual comparison," *Elements*, April 18, 2023.

Bhutada, Govind, "Visualizing China's Dominance in Battery Manufacturing (2022-2027P)," *Visual Capitalist*, January 19, 2023.

Black, Forbes, "AC Propulsion – The quiet revolutionaries," *Evworld*, October 27, 2009.

Black, Thomas, Beth Jinks, and Rick Clough, "Peltz-Immelt showdown heats up as GE rushes to boost profits," *Bloomberg*, March 23, 2017.

Blanco, Sebastian, "Tesla EV chargers are best in the business, says JD Power," *Car&Driver*, July 1, 2023.

Bleakley, Daniel, "1300 recycled electric vehicle batteries used for biggest grid-scale storage system of its kind," *The Driven*, February 8, 2023.

Bloomberg, "Tesla secures up to $521 million in China bank loans for plant," *Los Angeles Times*, March 7, 2019.

Boudette, Neal, "Tesla shines during the pandemic as other automakers struggle," *New York Times*, July 2, 2020.

Brown, Abby, Jeff Cappellucci, Alexia Heinrich, and Emma Cost, "Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: Fourth Quarter 2023," National Renewable Energy Lab, May 2024.

Bunge, Jacob, "DuPont CEO Ellen Kullman steps down," *Wall Street Journal*, October 5, 2015.

Burch, Sean, "Elon Musk anointed himself 'Technoking of Tesla' in cheeky SEC filing," *The Wrap*, March 15, 2021.

California Air Resources Board, "History," CARB (accessed August 18, 2024).

California Air Resources Board, "Zero-emission vehicle program," CARB (accessed August 18, 2024).

Cao, Sissi, "Rare photo of the Elon Musk's $50,000 tiny home shared by biographer," *Observer*, August 7, 2023.

Carlier, Mathilde, "New vehicle average selling price in the United States from 2016 to 2022,"*Statista*, June 7, 2023.

Carpenter, Marie, and William Lazonick, "Losing Out in Critical Technologies: Cisco Systems and Financialization," *Institute for New Economic Thinking*, February 28, 2023.

Catsaros, Oktavia, "Lithium-Ion battery pack prices hit record low of $139/kWh," *BloombergNEF*, November 26, 2023.

CBS, "Rivian joining Tesla charging network, inches closer to becoming industry standard," *CBS*, June 20, 2023.

Chappell, Bill, "Tesla unveils its electric 'Semi' truck, and adds a Roadster," *NPR*, November 17, 2017.

Chen, Brian X., and Tripp Mickle, "Behind Apple's doomed car project: False starts and wrong turns," *New York Times*, February 28, 2024.

Chokshi, Niraj, and Jack Ewing, "He helped build Tesla. Now he's gunning for it," *New York Times*, November 18, 2021.

Coffee Jr., John C., and Darius Palia, "The Wolf at the Door: The Impact of Hedge Fund Activism on Corporate Governance," *Journal of Corporation Law*, 41, 3, 2016: 545-603.

Coren, Michael, "Tesla's cheaper, more powerful battery cell is the perfect embodiment of its factory model," *Quartz*, January 5, 2017.

Coren, Michael, "Tesla's entire future depends on the Gigafactory's success, and Elon Musk is doubling down," Quartz, August 3, 2016.

Cowan, Richard, and Andy Sullivan, "Rambling Trump, Musk interview marred by tech issues," *Reuters*, August 12, 2024.

Cox Automotive, "A record 1.2 million EVs were sold in the U.S. in 2023, according to estimates from Kelley Blue Book," *Cox Automotive*, January 9, 2024.

Crownhart, Casey, "What's next for batteries," *MIT Technology Review*, January 4, 2023.

Darlin, Damon, "Dell chief is replaced by founder," *New York Times*, February 1, 2007.

Davenport, Coral, and Jack Ewing, "Can Trump really slam the brakes on electric vehicles?" *New York Times*, May 27, 2024.

Davis, Joshua, "Batteries Included," *Wired*, August 1, 2006.

Delaware Court of Chancery, "Post-trial opinion" Richard J. Tornetta v. Elon Musk, Robyn J. Denholm, Antonio J. Gracias, James Murdoch, Linda Johnson Rice, Brad W. Buss, and Ira Ehrenpreis, and Tesla, Inc., In the Court of Chancery of the State of Delaware, April 25, 2024.

Di Grandi, Tessa, "Visualized: The EV mineral shortage," *Visual Capitalist*, February 8, 2022

Di Paolo Emilio, Maurizio, "Battery swapping supports U.S. electrification goals," *EETimes*, June 28, 2023.

Dixon, Chris "Driving; Lots of zoom with batteries," *New York Times*, September 19, 2003

Dunn, Jessica, "Are there enough materials to manufacture all the electric vehicles needed?" Union of Concerned Scientists, November 15, 2022.

Eavis, Peter, "How Elon Musk helped to lift the bar on C.E.O. pay," *New York Times*, June 25, 2022.

Eavis, Peter, "Delaware judge questions Tesla about vote on Elon Musk's Tesla pay," *New York Times*, August 2, 2024.

Eberhard, Martin, and Marc Tarpenning, "The 21st Century Electric Car," *Tesla*, October 9, 2006.

Eckhouse, Brian, "Tesla wouldn't be Tesla without stimulus spending," *Bloomberg*, June 9, 2020.

Elliott, Philip, "Trump is harnessing voter anxiety about electric vehicles," *Time*, June 17, 2024.

Evers, Andrew, Jeniece Pettitt, Lisa Setyon, Lora Kolodny, "How Tesla may have just killed it most important product—its Superchargers," *CNBC*, May 14, 2024.

Ewing, Jack, "Tesla will lay off more than 10% of workers," *New York Times*, April 15, 2024.

Ferris, David, "Why America's EV chargers keep breaking," *Politico*, April 12, 2023.

Forbes, "The real-time billionaires list," *Forbes* (accessed August 8, 2024).

Fox Rubin, Ban, "Jeff Bezos' $150 billion divorce: What you need to know," *CNET*, April 4, 2019.

Gabbatt, Adam, "Value of X has fallen 71% since purchase by Musk and name change from Twitter," *Guardian*, January 2, 2024.

Gage, Tom, "Who Killed the Electric Car?", Tom Gage, CEO of AC Propulsion, provides customer testimonial for SAP Business By Design," *Mergers and Acquisitions: The Dealmaker's Journal*, May 1, 2011.

Gagnon, Dallas, "Tesla to lay off more than 7,000 workers in the US through August," *MassLive*, May 20, 2024.

Gara, Antoine, "Deal of the century: How Michael Dell turned his declining PC business into a $40 billion windfall," *Forbes*, August 3, 2021.

Gavin, William, “Elon Musk wanted to lay off 20% of Tesla’s workforce, report says,” *Quartz*, April 22, 2024.

Gemstar International Group, “Gemstar acquires NuvoMedia, Inc. and SoftBook Press, Inc.,” *Information Today*, March 2000.

Gitlin, Jonathan, “You won’t be confused about electric vehicle charging after reading this,” *Arstechnica*, July 28, 2022.

Gius, Isabelle, “Tax breaks cushion Tesla’s Texas landing,” *American Prospect*, April 25, 2022.

Gokmen, Mufit Yilmaz, “Mass(ive) production and price cuts: How did the Tesla-Panasonic alliance thrive over the years?” *Globalfleet*, January 23, 2024.

Gomes-Casseres, Benjamin, “What Toyota learned and GM didn’t,” *Harvard Business Review*, September 1, 2009.

Good Jobs First, “Subsidy tracker individual entry, Tesla,” *Good Jobs First* (accessed September 6, 2023);

Gryta, Thomas, David Benoit, and Joann S. Lublin, “GE gives activist Trian a seat on the board,” *Wall Street Journal*, October 9, 2017.

Gupta, Poornima, “Electric carmaker Tesla files for IPO,” *Reuters*, January 29, 2010.

Hals, Tom, “Google settlement clears way for news Class C stock,” *Reuters*, June 17, 2013.

Hals, Tom, “DuPont wins board proxy fight against activist investor Peltz,” *Reuters*, May 13, 2015.

Hals, Tom, “Court upholds Musk's win in $13 billion lawsuit over Tesla-SolarCity deal,” *Reuters*, June 6, 2023.

Hamilton, Isobel Asher, “How Elon Musk transformed his cousins' solar panel company into Tesla Energy, which has faced lawsuits from angry shareholders and consumers,” *Business Insider*, April 29, 2022.

Hawkins, Andrew J., “Tesla Supercharger chief was fired because she challenged Musk,” *The Verge*, May 15, 2024.

Hawkins, Andrew J., “Tesla investors sue Elon Muck for launching a rival AI company, *The Verge*, June 13, 2024.

He, Laura, “Tesla delivers first China-made Model 3s to its own workers,” *CNN*, December 30, 2019.

Hernandez, Joe, “COP26 sees pledges to transition to electric vehicles, but key countries are mum,” *NPR*, November 10, 2021.

Higgins, Tim, "Elon Musk, tech's cash-poor billionaire," *Wall Street Journal*, May 8, 2020.

Higgins, Tim and Takashi Mochizuki, "Tesla needs its battery maker. A culture clash threatens their relationship," *Wall Street Journal*, October 8, 2019.

Hopkins, Matt, and William Lazonick, "The Mismeasure of Mammon: Uses and Abuses of Executive Pay Data," Institute for New Economic Thinking Working Paper No. 49, August 29, 2016.

Hopkins, Matt, and William Lazonick, "How GM's $10-Billion Buyback May Ice Its EV Transition," *Institute for New Economic Thinking*, December 18, 2023.

Huang, Jerry, "A comparison of NMC/NCA lithium ion battery and LFP battery," *POWorks*, November 6, 2020.

Hull, Dana, "Tesla reviving defunct auto plant," *Los Angeles Times*, September 29, 2010,

Hull, Dana, and Kurt Wagner, "Elon's orbit," *Bloomberg*, May 29, 2024.

Igleheart, Austin, "State Policies Promoting Hybrid and Electric Vehicles," National Conference of State Legislatures, August 23, 2023.

International Energy Agency, "Electric Vehicles," *IEA*, September 2022.

International Energy Agency, "Global EV Outlook 2022," *IEA*.

International Energy Agency, "Global EV Data Explorer," *IEA*, April 23, 2024.

International Energy Agency, "Electric vehicles," *IEA50*, June 24, 2024.

International Energy Agency, "Global EV data", *IEA50* (accessed August 14, 2024).

International Energy Agency, "Trends in charging infrastructure," *Global EV Outlook 2023* (accessed August 19. 2024).

International Organization of Motor Vehicle Manufacturers (OICA), "Production Statistics," *OICA*, various years.

International Organization of Motor Vehicle Manufacturers, "2017 Production Statistics," *OICA* (accessed June 4, 2024).

Irie, Roland, "Global EV sales for 2023," *EV Volumes*, January 22, 2024.

IRS, "Manufacturers and models for new qualified clean vehicles purchased in 2022 and before," Internal Revenue Service (accessed August 19, 2024)

Isaacson, Walter, *Elon Musk*, Simon & Schuster, 2023.

Jaskula, Brian, "2013 Minerals Yearbook: Lithium," *United States Geological Survey*, January 2015.

Jin, Hyunjoo, and Sheila Dang, "Musk says U.S. SEC 'bastards'forced settlement over Tesla tweets," *Reuters*, April 14, 2022.

Jin, Hyunjoo, and Chibuike Oguh, "Explainer: How Elon Musk funded the $4 billion Twitter deal," *Reuters*, October 28, 2022.

Jin, Hyunjoo, Ross Kerber, and Tom Hals, "Tesla plans to leverage Elon Musk's big pay win in Delaware court battle," *Reuters*, June 14, 2024.

Jin, Hyunjoo, Makiko Yamazaki, Yilei Sun, and Edward Taylor, "Exclusive: LG Chem to double China battery capacity to meet Tesla demand - sources ," *Reuters*, December 1, 2020.

Kane, Mark, "US: All-electric car sales surged in January 2023—7% market share," *InsideEVs*, March 18, 2023.

Kane, Mark, "U.S. EV sales ended 2023 at 1.1 million," *InsideEVs*, January 18, 2024.

Kane, Mark, "Half of all Tesla EVs are made In China," *InsideEVs*, April 10, 2024.

Katsumura, Mariko, Daniel Leussink, and Akash Sriram, "Panasonic says Oklahoma no longer candidate for new battery plant," *Reuters*, December 20, 2023.

Kędzierski, Michał, "Unplugged. The uncertain future of electromobility in Germany," *Centre for Eastern Studies*, March 13, 2024.

Kim, Tae, and Leslie Picker, "Elon Musk's tweet about going private costs Tesla short sellers $1.3 billion," *CNBC*, August 8, 2018.

Kim, Young-gyo, "Apple turns to Chinese makers for its battery supply," *Yonhap English News*, November 29, 2012.

Kirkham, Chris, Hyunjoo Jin, and Adhirup Roy, "The inside story of Elon Musk's mass firings of Tesla Supercharger staff," *Reuters*, May 15, 2024.

Kolodny, Lora, "As Tesla layoffs continue, here are 600 jobs the company cut in California," *CNBC*, May 17, 2024.

Kolodny, Lora, "Elon Musk ordered Nvidia to ship thousands of AI chips reserved for Tesla to X and xAI," *CNBC*, June 4, 2024.

Kolodny, Lora, "Tesla internal data shows company has slashed at least 14% of workforce this year," *CNBC*, June 21, 2024.

Krauskopf, Lewis, "Nelson Peltz's Trian takes $2.5 billion stake in General Electric," *Reuters*, October 5, 2015.

Krisher, Tom, "How Elon Musk's $44.9 billion pay package compares with the most generous plans for other U.S. C.E.Os," *Associated Press*, June 15, 2024.

Lambert, Fred, "Tesla's original team, where are they now?" *Electrek*, May 16, 2015.

Lambert, Fred, "Tesla confirms having produced its 300,000th electric car," *Electrek*, February 14, 2018.

Lambert, Fred, "Tesla launches new multi-state effort against direct sales ban," *Electrek*, January 28, 2019.

Lambert, Fred, "Tesla expands beyond solar at Gigafactory New York to meet employment requirements," *Electrek*, June 7, 2021.

LaMonica, Martin, "Tesla Motors founders: Now there are five," *CNET*, September 21, 2009.

Landis Weaver, Rosanna, and Melissa Walton, "The 100 most overpaid CEOs," *As You Sow*, February 2022.

Lazonick, William, "Apple's 'Capital Return' Program: Where Are the Patient Capitalists?" *Institute for New Economic Thinking*, November 13, 2018.

Lazonick, William, "The secret of Amazon's success," *New York Times*, November 19, 2018.

Lazonick, William, "The Theory of Innovative Enterprise: Foundations of Economic Analysis," in Thomas Clarke, Justin O'Brien, and Charles R. T. O'Kelley, eds., *The Oxford Handbook of the Corporation*, Oxford University Press, 2019: 490-514.

Lazonick, William, *Investing in Innovation: Confronting Predatory Value Extraction in the US Corporation*, Cambridge University Press, 2023.

Lazonick, William, and Matt Hopkins, "Corporate executives are making way more money than anyone reports," *The Atlantic*, September 15, 2016.

Lazonick, William, and Matt Hopkins, "If the SEC Measured CEO Pay Packages Properly, They Would Look Even More Outrageous," *Harvard Business Review*, December 22, 2016.

Lazonick, William, and Matt Hopkins, "Comment on the Pay Ratio Disclosure Rule," public comment to the U.S. Securities and Exchange Commission, March 21, 2017.

Lazonick, William, and Matt Hopkins, "General Electric in the Grip of Predatory Value Extractors," Academic-Industry Research Network unpublished note, April 4, 2021, as a contribution to Nick Juravich and Arthur C. Wheaton, "Building a Sustainable Future for General Electric in Schenectady, New York, and Lynn, Massachusetts," School of Industrial and Labor Relations, Cornell University, and Labor Resource Center, UMass Boston, November 2021, posted at IUE-CWA Local 201.

Lazonick, William, and Matt Hopkins, "How Intel Financialized and Lost Leadership in Semiconductor Fabrication," *Institute for New Economic Thinking*, July 7, 2021.

Lazonick, William, and Matt Hopkins, "Why the CHIPS Are Down: Stock Buybacks and Subsidies in the U.S. Semiconductor Industry," Institute for New Economic Thinking Working Paper No. 165, November 1, 2021.

Lazonick, William, and Ken Jacobson, "Letter to SEC: How Stock Buybacks Undermine Investment in Innovation for the Sake of Stock-Price Manipulation," *Institute for New Economic Thinking*, April 1, 2022.

Lazonick, William, and Mustafa Erdem Sakinç, "Make Passengers Safer? Boeing Just Made Shareholders Richer," *American Prospect*, May 31, 2019.

Lazonick, William, and Jang-Sup Shin, *Predatory Value Extraction: How the Looting of the Business Corporation Became the US Norm and How Sustainable Prosperity Can Be Restored*, Oxford University Press, 2020.

Lazonick, William, Matt Hopkins, and Ken Jacobson, "What We Learn about Inequality from Carl Icahn's $2 Billion 'No Brainer'," *Institute for New Economic Thinking*, June 6, 2016.

Lemos Stein, Mara, "Tesla signs up Daimler and knocks on DOE's door," *Dow Jones News Service*, May 20, 2009.

Leopold, Les, "Will the Democrats Listen to Shawn Fain?" *Wall Street's War of Workers*, August 29, 2024.

LeVine, Steve, "Why Elon Musk has bet on Asian battery makers over American battery startups," *The Information*, July 18, 2021.

Lienert, Paul, "As electric cars take off, makers pledge $11.3 billion for US lithium iron phosphate," *Reuters*, June 23, 2023.

Loh, Matthew, "Elon Musk says laying off 80% of Twitter's staff was 'painful' and 'one of the hardest things' he's had to do as the platform's boss," *Business Insider*, April 12, 2023.

Lombardo, Tom, "Why EV manufacturers are switching from NMC to LFP batteries," *Engineering*, September 30, 2022.

Loveday, Steven, "EV battery cell & pack prices dropping at surprising rate," *InsideEVs*, December 2, 2021.

Lu, Marcus, "Visualizing global electric vehicle sales in 2023," *The New Diplomat*, March 11, 2024.

Mann, Mark, "The story of Elon Musk's first company," *SiteBuilderReport*, June 16, 2022.

Matousek, Mark, "SEC reportedly investigating whether Elon Musk tried to hurt short-sellers with his 'funding secured' tweet," *Business Insider*, August 16, 2018.

Mc, Jen, "Rising with Tesla, falling to Toyota: The Panasonic battery chronicles," *Medium*, December 8, 2023; Gokmen, "Mass(ive) production and price cuts".

McCormick, Kathaleen St. J., "Tornetta v. Musk," Court of Chancery of the State of Delaware, January 30, 2024.

McFadden, Robert D, "John B. Goodenough, 100, dies; Nobel-winning creator of the lithium-ion battery," *New York Times*, June 26, 2023.

McGregor, Jena, and Thomas Heath, "GE's CEO Jeffrey Immelt to step down after 16 years," *Washington Post*, June 12, 2017.

McGurk, Jamie, Stephen McDermid, Vishal Amin, and Irvin Chan, "Making sense of the Dell-EMC-VMware deal," *Forbes*, October 27, 2015.

McKerracher, Colin, "EV charging data shows widely divergent global path," *Bloomberg New Energy Finance*, April 15, 2021.

Meta DEF 14A 2024 Proxy Statement.

Mihalascu, Dan, "Tesla's Fremont is the most productive car plant in North America," *InsideEVs*, January 24, 2022.

Morrison, Charles, *Tesla: How Elon Musk and Company Made Electric Cars Cool, and Remade the Automotive and Energy Industries*, Charles Morrison, 4.4 edition, 2021.

Motley Fool Transcribing, "Tesla (TLSA) Q4 2023 earnings call transcript," *The Motley Fool*, January 24, 2024.

Musk, Elon, "The Secret Tesla Motors Master Plan (just between you and me)," *Tesla Motors*, August 2, 2006.

Musk, Elon, "Master Plan Part Deux," *Tesla*, July 20, 2016.

National Archives, "National Electric Vehicle Infrastructure Standards and Requirements," *Federal Register*, February 28, 2023.

Niedermeyer, Edward, *Ludicrous: The Unvarnished Story of Tesla Motors*, BenBella Books, 2019.

O'Kane, Sean, "Tesla signs agreement to build cars in China," *Verge*, July 10, 2018.

O'Leary, Tim, "Tesla Store Los Angeles," *Tesla press release*, May 14, 2008.

Opletal, Jiri, "Tesla prepares for Giga Shanghai phase 3 expansion to produce 25,000 USD vehicle," *CarNewsChina*, December 6, 2023.

Orol, Ronald, "How Elon Musk controls Tesla with only a minority ownership stake," *The Street*, April 23, 2018.

Owens, Jeremy, "Elon Musk teases massive Tesla stock buyback as CFO trims forecast for annual deliveries and stock falls," *MarketWatch*, October 22, 2022.

Pacheco, Inti, and Theo Fracis, "The highest paid CEOs in the S&P 500: The top pay packages in 2021," *Wall Street Journal*, May 15, 2022.

Palmer, Annie, "Amazon announces 20-for-1 stock split, $10 billion buyback," *CNBC*, March 9, 2022.

Panasonic, "Panasonic and Tesla reach agreement to expand supply of automotive-grade battery cells," *Panasonic press release*, October 30, 2013.

Panasonic, "Toyota and Panasonic decide to establish joint venture specializing in automotive prismatic batteries," *Panasonic press release*, February 3, 2020.

Picchi, Aimee, "Tesla shareholders approve $46 billion pay package for CEO Elon Musk," *CBS News*, August 2, 2024.

Pierson, Sam, "Tesla: Most shorted stock ever?" *S&P Global*, August 16, 2018.

Plumer, Brad, and Hiroko Tabuchi, "6 automakers and 30 countries say they'll phase out gasoline car sales," *New York Times*, November 9, 2021.

Pontes, José, "Tesla #1 in world BEV sales by big margin—2022 World EV Sales Report," *Cleantechnica*, 2023.

Pontes, José, "Wo*rld EV sales report — Tesla Model Y is the best selling model in the world!," Cleantechnica*, February 2024.

Pound, Jesse, "GE to break up into 3 companies, focusing on aviation, health care, and energy," *CNBC*, November 9, 2021.

Pressman, Matt, "From Tzero to Model S; How AC Propulsion was a catalyst for Tesla Motors," *Evannex*, February 6, 2016.

Q.ai, "Elon Musk sells another $3.6 billion in Tesla stock to prop up Twitter," *Forbes*, December 29, 2022.

Ramzy, Austin, "Tesla Model 3 orders surge even before its unveiling," *New York Times*, April 1, 2016.

Reichon, George, "Tesla's secret second floor," *Wired*, October 18, 207l

Reuters, "Dell returns to public markets after 6 years," *VentureBeat*, December 28, 2018.

Reuters, “German government agrees proposals for tax relief on EVs,” *Reuters*, September 4, 2024.

Ritchie, Hannah, “Does the world have enough lithium to move to electric vehicles?” *Sustainability by Numbers*, January 25, 2023.

Ritholtz, Barry, “Transcript: Peter Rawlinson, Lucid CEO/CTO,” *Ritholtz*, June 25, 2024.

Root, Al, “Tesla boosted output at its plant in China. It had to,” *Barron’s*, September 5, 2023.

Root, Al, “Is Elon Musk worth some $50 billion?” *Barron’s*, June 14, 2024.

Royal Swedish Academy of Sciences, “The Nobel Prize in Chemistry, 2019,” The Nobel Prize (accessed June 2, 2024).

Scarosati, Bruno, “History of Lithium Batteries,” *Solid State Electrochemistry*, 15, 7-8, 2011: 1623-1630.

Shead, Sam L., “Tesla whale calls for $15 billion stock buyback after share price craters,” *CNBC*, May 19, 2022.

Sherman, Don, “Tesla’s towering electric oak tree grew from this little-known acorn,” *Hagerty*, March 9, 2021.

Shnayerson, Michael, “Quiet Thunder,” *Vanity Fair*, May 2007.

Siry, Darryl, “Mythbusters part 2: The Tesla Roadster is not a converted Lotus Elise,” *Tesla Motors*, March 3, 2008.

Smith, Allan, “With violent rhetoric, Trump fights electric vehicles to defeat Biden in Michigan,” *NBC News*, April 9, 2024.

Smith, Dave, “How Elon Musk cleverly manipulated 7 states to compete for Tesla's huge factory,” *Business Insider*, November 14, 2013.

Sorokanich, Bob, “Elon Musk admits to shareholders that the Tesla Roadster was a disaster,” *Road & Track*, June 1, 2016.

Sparks, Daniel, “Tesla to make a surprise announcement in China,” *Yahoo!Finance*, May 28, 2019.

St. John, Jeff, “EV chargers have a big reliability problem. Can the government fix it?” *CanaryMedia*, December 11, 2023.

Staff and wire reports, “Dell takes top spot in PC market,” *CNN*, April 23, 2001.

Stahl, Lesley, “Tesla CEO Elon Musk: The 60 Minutes Interview,” *CBS News*, December 9, 2018.

Stark, Clinton, “In photos: Tesla’s factory pickup experience (Fremont),” *StarkInsider*, April 22, 2013.

Stenquist, Peter, “Why you might buy your next car online,” *New York Times*, June 21, 2022.

Subramanian, Pras, “‘You can’t just go to electric’: Trump sounds off on EV transition as automakers warn on demand,” *Yahoo!Finance*, March 11, 2024.

Sullivan, Mark, “Apple doesn’t like to be called an AI laggard,” *Fast Company*, August3, 2023.

Sun, Yilei, and Tony Munroe, “Chinese EV battery maker CATL extends deal with Tesla,” *Reuters*, June 28, 2021.

Tay, Kah Seng, “How much equity did Elon Musk get from investing In Tesla's Series A?” *Forbes*, Dec 29, 2014.

Tesla 10-K filings with the SEC, 2010-2023.

Tesla DEF 14A Proxy Statements, 2011-2024.

Tesla shareholder letters, 2010-2024.

Tesla, “Tesla unveils world's first mass-produced, highway-capable EV,” *Tesla press release*, March 26, 2009.

Tesla, “Tesla gets loan approval from US Department of Energy,” *Tesla press release*, April 20, 2010.

Tesla, “Tesla Motors announces senior engineering and manufacturing executives,” *Tesla press release*, April 20, 2010.

Tesla, “Tesla Motors surpasses 500th 2008 Roadster reservation,” *Tesla*, April 20, 2010.

Tesla, “Tesla takes more than 500 Model S reservations in a week,” *Tesla press release*, April 20, 2010.

Tesla, Amended and Restated Bylaws of Tesla Motors, Inc., (initially adopted on July 17, 2003), (amended and restated on December 16, 2009 and effective as of the closing of the corporation’s initial public offering), (as amended and restated on June 6, 2012).

Tesla, “Tesla Motors launches revolutionary supercharger enabling convenient long distance driving,” *Tesla press release*, September 24, 2012.

Tesla, “Tesla Motors, Inc. – Third Quarter 2012 Shareholder Letter,” *sec.gov*, November 5, 2012.

Tesla, “Tesla improves financing product with best resale value guarantee and lower monthly payments,” *Tesla press release*, May 3, 2013.

Tesla, “Tesla Motors announces offerings of common stock and convertible senior notes,” *Tesla press release*, May 11, 2013.

Tesla “Tesla repays Department of Energy loan nine years early,” *Tesla press release*, May 22, 2013.

Tesla, “Panasonic and Tesla sign agreement for the Gigafactory,” *Tesla press release*, July 30, 2014.

Tesla, “Tesla second quarter 2017 update,” *Tesla press release*, August 2, 2017.

Tesla, “Tesla 1Q 2018 vehicle production and deliveries,” *Tesla press release*, April 3, 2018.

Tesla, “Tesla to host autonomy investor day,” *Tesla press release*, April 3, 2019.

Tesla, “Tesla announces a three-for-one stock split,” *Tesla press release*, August 5, 2022.

Tesla, “Impact Report 2023,” *Tesla*, p. 40 (accessed August 19. 2024).

Tesla, “Q4 2023 shareholder deck,” *Tesla*, January 24, 2024.

Tesla, “Tom Zhu,” *Tesla Corporate Governance* (accessed, September 2, 2024).

Tesla, Form 8-K Report to the Securities and Exchange Commission, June 1, 2024.

Tesla Team, “Tesla and SolarCity to combine,” *Tesla press release*, August 1, 2016.

Tesla Team, “The week that electric vehicles went mainstream,” *Tesla press release*, April 7, 2016.

Tesla Team, “Battery cell production begins at the Gigafactory,” *Tesla press release*, January 4, 2017.

The White House, “Fact Sheet: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China,” Briefing Room, August 9, 2022.

Transportation Research Center at Argonne National Laboratory, *“U.S. Plug-in Electric Vehicle Sales by Model,” Department of Energy, accessed 3/21/2024.*

U.S. Census Bureau, “Census Bureau estimates show average one-way travel time to work rises to all-time high,” U.S. Census, March 18, 2021.

U.S. Congress, “National Securities Markets Improvement Act of 1996,” Public Law 104-190, October 11, 1996.

U.S. Department of Energy, “U.S. Plug-in Electric Vehicle Sales by Model, 2011-2019,” Alternative Fuels Data Center (accessed June 4, 2024).

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Fact of the week," DOE, August 4, 2024.

U.S. Department of Transportation. "Charger types and speeds," DOT (accessed August 19, 2024)

U.S. Securities and Exchange Commission, "Elon Musk charged with securities fraud for misleading tweets," *SEC press release,* September 27, 2018.

U.S. Securities and Exchange Commission, "Elon Musk settles SEC fraud charges; Tesla charged with and resolves securities law charge," *SEC press release*, September 29, 2018.

Vance, Ashlee, *Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future*, Harper Collins, 2015.

Vaughn, Mark, "Tesla's little-known prehistory," *Autoweek*, March 1, 2021.

Venditti, Bruno, "The top 10 EV battery manufacturers in 2022," *Visual Capitalist*, October 5, 2022.

Vincent, John, "Tracking Nelson Peltz's Trian Fund Management Portfolio—Q42021," *Seeking Alpha*, February 20, 2022.

Walker, William, and Scott Evans, "Tesla Model S beats Chevy, Toyota, and Cadillac for ultimate car of the year honors," *Motortrend*, July 10, 2019.

Wayland, Michael, "GM to use Tesla charging network, joining Ford in leveraging the EV leader's tech," *CNBC*, June 8, 2023.

Wilson, Kevin, "The 120-year history of the electric car, in pictures," *Popular Mechanics*, December 16, 2015.

Wulandari, Fitri, "Who owns Amazon: 10 major AMZN shareholders in 2024," *Techopedia*, January 29,2024.

Yahoo!Finance, Tesla monthly stock-price data.

Yarrow, Jay, "Tesla team brawls over who deserves credit for the company," *Business Insider*, June 29, 2009.

Zhang, Phate, "Tesla begins construction of Shanghai Megafactory," *CNEVPost*, May 23, 2024.