

CASE STUDY

TESLA MOTORS

In 2013, Tesla Motors was a 4500-person company on track to set history. It had created two cars that most people agreed were remarkable. It had posted its first quarterly profit in 2013, and had repaid its government loans ahead of the major auto conglomerates. Most importantly, it looked like it might survive. Perhaps even thrive. This was astonishing as there had been no other successful auto manufacturing start up in the U.S. since the 1920s.

The road leading up to Tesla's position in 2013 had not always been smooth, and there were many doubts that still lingered. Tesla had benefited from the enthusiasm of the "eco-wealthy" - a rather narrow portion of the market. How would Tesla fare when it was in direct competition with General Motors, Ford, and Nissan for the mass market? Would it be able to turn a sustainable profit on its automaking operations? Furthermore, some questioned whether Tesla's goals to sell to the mass market even made sense. In the niche market, it had a privileged position with customers that were relatively price-insensitive and were seeking a stylish, high performance car that made an environmental statement. To compete for the mass market, the car would have to provide good value for the money (involving trade-offs that might conflict with Chairman Elon Musk's ideals), and the obstacles to charging would have to be overcome.

History of Tesla

In the year 2003, an engineer named Martin Eberhard was looking for his next big project. A tall, slim man with a mop of gray hair, Eberhard was a serial entrepreneur who had launched a number of start-ups, including a company called NuvoMedia, which he sold to Gemstar in a \$187 million deal. Eberhard was also looking for a sports car that would be environmentally friendly—he had concerns about global warming and U.S. dependence on the Middle East for oil. When he didn't find the car of his dreams on the market he began contemplating building one himself, even though he had zero experience in the auto industry. Eberhard noticed that many of the driveways that had a Toyota Prius hybrid electric vehicle (or "dork mobile" as he called it) also had expensive sports cars in them—making Eberhard speculate that there could be a market for a high performance environmentally friendly car. As explained by Eberhard, "It was clear that people weren't buying a Prius to save money on gas - gas was selling close to inflation-adjusted all-time lows. They were buying them to make a statement about the environment."

Eberhard began to consider a range of alternative fuel options for his car: hydrogen fuel cells, natural gas, diesel. However he soon concluded the highest efficiency and performance would come from a pure electric vehicle. Luckily for Eberhard, Al Cocconi (founder of AC Propulsion and one of the original engineers for GM's ill-fated EV-1) had concluded the same thing, and had produced a car called the tzero. The tzero could go from zero to 60 miles per hour in 4.1 seconds, but it was powered with extremely heavy lead-acid batteries, limiting its range to about 60 miles between charges. Eberhard approached Cocconi with the idea of using the lighter lithium ion batteries, which offered six times more energy per pound. Cocconi was eager to try out the idea (he had, in fact, been experimenting with lithium ion batteries himself), and the resulting lithium ion based tzero accelerated to 60 miles per hour in 3.6 seconds, and could travel more than 300

miles. Eberhard licensed the electric-drive-train technology from AC Propulsion, and founded his company, Tesla Motors (named after Nikola Tesla, a late 19th century and early 20th century inventor who developed, among other things, the AC electrical systems used in the U.S. today).

Meanwhile, there was another entrepreneur—one with much deeper pockets—also interested in developing electric vehicles based on the tzero: Elon Musk. In 2002, Elon Musk was a 31-year-old South African living in California, who had founded a company that ultimately became PayPal. After selling PayPal to eBay in 2002 for \$1.5 billion, he started a company called SpaceX with the ambitious goal of developing cheap, consumer space travel. (SpaceX's Dragon spacecraft ultimately made history in May of 2012 by becoming the first commercial vehicle to launch and dock at the International Space Station.) Musk was also the chairman of a high profile clean tech venture in Northern California called Solar City. Musk's glamorous and assertive style, and his astonishing record of high-tech entrepreneurship, made him one of the inspirations for the Tony Stark character in Jon Favreau's Iron Man movies.

Like Eberhard, Musk thought electric cars were the key to the U.S. achieving energy independence, and he approached Cocconi about buying the tzero. Tom Gage, who was then AC Propulsion's CEO, suggested that Musk collaborate with Eberhard. After a two hour meeting in February of 2004, Musk agreed to fund Eberhard's plan with \$6.3 million. He would be the company's chairman and Eberhard would serve as CEO.

The first Tesla prototype, named the Roadster, was based on the \$45,000 Lotus Elise, a fast and light sports car that seemed perfect for the creation of Eberhard and Musk's grand idea (see Figure 1a). The car would have 400 volts of electric potential, liquid-cooled lithium ion batteries, and a series of silicon transistors that would give the car acceleration so powerful the driver would be pressed back against their seat. It would be about as fast as a Porsche 911 Turbo, would not create a single emission, and would get about 220 miles on a single charge from the kind of outlet you would use to power a washing machine.

While the men at first worked well together, personality clashes soon began to emerge. Both were technically savvy and vigorously addressed problems within the company. As described by Laurie Yoler, Eberhard was "just brilliant, and he has this tenacity that is unbelievable . . . He is the guy you want around in those early days when you have naysayers all around." However, Eberhard could also be abrasive and critical. Musk, in turn, was not content to just financially back the company—he began to get intimately involved in decisions about the car's design and the operation of the company. Soon Musk and Eberhard were at odds over decisions such as the body panels (Eberhard preferred to stick with the fiberglass panels used in the original Elise; Musk wanted to use the lighter, stronger—and more expensive—carbon fiber), marketing (Eberhard had approved the hiring of PR professionals to build publicity for the car before its launch; Musk fired them, believing his own involvement and the car itself would generate enough publicity), and even the chassis (Eberhard wanted to reap the cost savings of sticking with the Elise's original crash-tested, off-the-rack chassis; Musk wanted to lower the door-sills by two inches to make the car easier to enter and exit). Musk also wanted to redesign the headlights and door latches, and replace the Elise's seats with more comfortable - and expensive - custom seats.

In each case, Musk's preference prevailed. As Musk insisted, "you can't sell a \$100,000 car that looks like crap," and Musk's views were hard to ignore given that he was putting more and more of his personal wealth into the company. By 2007 he had put in \$55 million of his own money into the company, and had also raised money from his other wealthy entrepreneur friends (that included eBay's second employee, Jeff Skoll, and Google founders Sergey Brin and Larry Page).

Musk's insistence on the best materials and parts, however, combined with Eberhard's inexperience as the manager of a major firm, resulted in delays and runaway costs. At a staff meeting in June 2007, Tom Colson, head of manufacturing, revealed a cost analysis suggesting that the average cost of the cars would be over \$100,000 for the first 50, and would decline only slightly with increased volume. Eberhard could not answer the financial questions of the venture capitalists on Tesla's board, and their confidence in him was eroded even further by his defense of "In any other company it's the CFO that provides those numbers . . . I'm an engineer, not a finance guy." In August of 2007, the board removed him as CEO and demoted him to president of technology. Then in October of 2007, Musk arranged for Eberhard to be ousted from the company entirely. Furious, Eberhard started a blog detailing what he called the "Stealth Bloodbath" going on at Tesla, and he would later sue Musk for libel, slander, and breach of contract.

Meanwhile, Eberhard's temporary replacement was Michael Marks, former CEO of Flextronics. Marks immediately created a priority list that identified items with potential to delay the car. He mothballed any plans for side projects and focused the entire business on streamlining costs and getting the Roadster out. Despite his efforts, the Roadster missed its deadline for beginning production at the Lotus facility, triggering a penalty built into the manufacturing contract Eberhard had signed with Lotus: a \$4 million fee.

By the beginning of 2008 morale was at an all-time low. In March, however, production began on the Roadster, and by July of 2008, most of the production problems had been forgotten as the first seven Roadsters (the "Founder's Series") hit the road. Enthusiasm for the cars was astonishing—the cars boasted an all-star list of celebrities with reservations to buy a car, and everywhere the Roadster drove, people (albeit mostly men) stopped to stare.

Musk's ambitions did not stop at a niche high-end car, however. He wanted to build a major U.S. auto company—a feat that had not been successfully accomplished since the 1920s. To do so, he knew he needed to introduce a less expensive car that could attract a higher volume of sales, if not quite the mass market. In June of 2008, Tesla announced the Model S—a high performance all-electric sedan that would sell for a price ranging from \$57,400 to \$77,400, and compete against cars like the BMW 5-series (see Figure 1b). The car would have an all-aluminum body, and a range of up to 300 miles per charge. The Model S cost \$500 million to develop, however offsetting that cost was a \$465 million loan Tesla received from the U.S. government to build the car, as part of the U.S. government's initiative to promote the development of technologies that would help the U.S. to achieve energy independence.

By May of 2012 Tesla reported that it already had 10,000 reservations for customers hoping to buy the Model S, and Musk confidently claimed the company would soon be producing—and selling—20,000 Model S cars a year. Musk also noted that after ramping up production, he expected to see "at least 10,000 units a year from demand in Europe and at least 5,000 in Asia."

The production of the Model S went more smoothly than that of the Roadster, and by June of 2012 the first Model S cars were rolling off the factory floor. The very first went to Jeff Skoll, eBay's first president, and a major investor in Tesla. On the day of the launch, Skoll talked with Musk about whether it was harder to build a rocket or a car (referring to Musk's SpaceX company): "We decided it was a car. There isn't a lot of competition in space."

To build the car, Tesla bought a recently closed automobile factory in Fremont California that had been used for the New United Motor Manufacturing Inc. (NUMMI) venture between Toyota and General Motors. The factory, which was far bigger than Tesla's immediate needs, would give the company room to grow. Further- more, though the plant and the land it was on had been appraised at around \$1 billion before NUMMI was shut down, Tesla was able to snap up the idled factory for \$42 million. Tesla also used the factory to produce battery packs for Toyota's RAV4, and a charger for a subcompact Daimler AG electric vehicle. These projects would supplement Tesla's income while also helping it to build scale and learning curve efficiencies in its technologies. Musk also had plans to produce a sport utility vehicle, the Model X, which would cost \$250 million to develop and would go into production in late 2013.

Obstacles to the Adoption of Electric Vehicles

There were a number of obstacles slowing the adoption of electric vehicles. The first was the price: Electric vehicles were, typically, significantly more expensive than comparable internal combustion models. Complicating matters still further, most consumers had a very difficult time estimating how much their cost of ownership for an electric car would be: How much would they pay to charge at home? How much would they pay to charge away from home? What would the maintenance and repairs of an electric vehicle cost? How long would the battery and/or car last? Would it have resale value? To lessen these concerns, Elon Musk set out to make the cost of owning a Tesla as certain as possible. First, he created a "Super- charger" network that Model S owners could use for free, for the life of the car. As noted by Musk, "The clearest way to convey the message that electric cars are actually better than gasoline cars is to say charging is free." The hitch was that a user had to be within range of one of the Supercharger stations. Second, Musk announced an unprecedented price protection guarantee that permitted a Model S owner to trade in their car for a designated residual value anytime within the first three years of the cars life. Musk also announced plans to offer free repairs, and a free replacement car while a customer's car was being repaired. Needless to say, analysts were scratching their heads at the potential costs of these promises.

The second major obstacle to the adoption of electric vehicles was their limited range and associated "range anxiety" (people's concerns about driving in places where they were not sure they would be able to charge their cars). These concerns were not so much of an issue for the Tesla cars due to their exceptionally long range. The other "mass market" electric vehicles faced tougher hurdles. For example, though a Nissan Leaf could be charged at an ordinary 110 household outlet, a full charge by this method could take eight hours. Level 2 charging with a 220-volt outlet could shorten that time to four hours, but this was still completely impractical for recharging during a trip. DC Fast Chargers and Tesla's "Superchargers" promised to fully charge a vehicle in 30 minutes or less. While this is still significantly longer than the typical 6-minute gasoline fill-up, it

meant that charging could be feasible if it were collocated with other services that drivers might appreciate, such as restaurants or coffee shops. There were, however, only six Tesla Supercharging stations in the world at the beginning of 2013.^{xv} DC Fast Chargers and Tesla's Supercharging stations were expensive to purchase and install—up to \$250,000 depending on the location—and they needed to be close to heavy-duty electricity transformers.

Competition in the Electric Vehicle Market

Hybrid electric vehicles (HEV, such as the Toyota Prius) made their appearance in the U.S. auto market in 2000. These vehicles were readily adopted by consumers because they require no change in typical consumer usage habits—they are filled with gasoline and will automatically switch between electric miles and gasoline miles. Most such HEVs, however, have extremely limited electric range. For many, ten miles of electric driving before switching over to gas is the norm. This limits their ability to reduce carbon emissions or to influence energy usage. All-electric vehicles (also called Plug-in Electric vehicles, known alternatively as AEV or PEV) get all of their energy from electricity. They are thus considered true zero-emission vehicles. Plug-in Hybrid Electric vehicles (PHEV) such as the Chevy Volt plugged in to charge, but could also use gas.

A number of automakers were introducing electric vehicles by 2013 - in large part due to California's CARB standards that mandated that for automobiles to be sold in California, a certain portion of an automaker's fleet had to be emission free. As a result, some automakers were willing to produce all-electric vehicles at a loss in order to be able to also sell more lucrative internal combustion models. (It was these California's zero-emissions mandates that had spurred a flurry of introductions of electric vehicles in the early 1990s. The subsequent downscaling of California's zero-emission mandate in the late 1990s led GM, Toyota, Honda, and Ford to shut down their loss-making EV programs, including most notoriously, GM's EV-1s, which were literally torn from their owners and crushed, as shown in the film "Who Killed the Electric Car?") Other automakers opted to buy zero-emission credits from those companies that sold more than their required proportion of zero-emission vehicles. Tesla was one such automaker who had surplus credits (since it produced no internal combustion vehicles), and as a result Tesla earned roughly \$68 million selling its ZEV credits in the first quarter of 2013.

Several companies had attempted to enter the all-electric vehicle market, but run out of cash and ceased operations. These included Fisker, Coda, Azure Dynamics, Bright Automotive, and others. The more serious competition was coming from established automakers who had deeper pockets to withstand the losses of building the electric vehicle market. Among these, there were a few competing cars that had sold significant (though still small) numbers of cars into the market. The Nissan Leaf, for example, retailed for about \$35,000, and had a range of about 90-100 miles per charge. It had sold 25,000 units in the U.S. and 50,000 worldwide by June of 2013. The Chevy Volt was a plug-in hybrid that could travel about 40 all-electric miles per charge, and an additional 340 miles on gasoline (making it a good solution for individuals that primarily made short commutes, but also wanted to be able to drive the car long distances without "range anxiety"). It also retailed for about \$35,000, and had sold over 20,000 units in the U.S. by June of 2013 (see Figure 2).

Figure 2**U.S. Electric Vehicle Sales**

Company	June 2013	June 2012	% Change	YTD 2013	YTD 2012	% Change
Ford	7736	1354	471.34	46197	8992	413.76
Ford C-Max Hybrid	2889	0	–	17858	0	–
Ford C-Max Energi PHEV	455	0	–	2482	0	–
Ford Escape Hybrid	0	17	–	0	1281	–
Ford Focus Electric	177	89	98.88	900	97	827.84
Ford Fusion Hybrid	3057	797	283.56	20283	4988	306.64
Ford Fusion Energi PHEV	390	0	–	1584	0	–
Lincoln MKZ Hybrid	768	451	70.29	3090	2626	17.67
GM	2831	1927	46.91	10660	10020	6.39
Chevy Volt	2698	1760	53.30	9855	8817	11.77
Other hybrids	133	167	–20.36	805	1203	–33.06
Honda	1758	1566	12.26	9302	10712	–13.16
Honda Civic Hybrid	568	548	3.65	3141	4118	–23.73
Honda CR-Z	393	409	–3.91	2415	2404	0.46
Honda Insight	384	494	–22.27	2362	4041	–41.55
Honda Fit EV	208	0	–	291	0	–
Honda Accord PHEV	42	0	–	200	0	–
Acura ILX Hybrid	163	115	41.74	893	149	499.33
Mitsubishi						
Mitsubishi i	39	33	18.18	882	333	164.86

(Continued)

Company	June 2013	June 2012	% Change	YTD 2013	YTD 2012	% Change
Nissan						
Nissan Leaf	2225	535	315.89	9839	3148	212.55
Porsche	66	67	-1.49	372	909	-59.08
Porsche Cayenne S Hybrid	62	42	47.62	294	669	-56.05
Porsche Panamera Hybrid	4	25	-84.00	78	240	-67.50
Toyota	30663	25776	18.96	176506	169113	4.37
Toyota Prius Liftback	14066	11514	22.16	76809	83205	-7.69
Toyota Prius C	3442	3657	-5.88	20575	16251	26.61
Toyota Prius V	2987	3284	-9.04	18616	22851	-18.53
Toyota Prius PHEV	584	695	-15.97	4214	4347	-3.06
Toyota Camry Hybrid	3878	3459	12.11	23834	23538	1.26
Toyota Highlander Hybrid	550	496	10.89	2960	3051	-2.98
Toyota Avalon Hybrid	1394	0	-	8348	0	-
Toyota RAV4 EV	44	0	-	408	0	-
Lexus Hybrids	3718	2671	39.20	20742	15870	30.70
Volkswagen						
Volkswagen Jetta Hybrid	438	0	-	2219	0	-
Total 100% Electrics	2693	657	309.89	12320	3578	244.33
Total PHEVs	4169	2455	69.82	18335	13164	39.28
Total Conv. Hybrids	38894	28146	38.19	225322	186485	20.83
TOTAL	45756	31258	46.38	255977	203227	25.96

Source: EVObsession, June Electric Vehicle Sales, Published July 4, 2013 at <http://evobsession.com/electric-vehicles-sales-update-june-2013-sales/june-electric-vehicle-sales/>

Tesla's Strategies

Automated Manufacturing

In 2013, all of Tesla's manufacturing was performed at its Fremont plant. Its manufacturing process was highly automated, with extensive use of eight-to ten-foot-tall red robots, reminiscent of Iron Man. Each robot had a single multi-jointed arm. While typical auto factory robots perform only one function, Tesla's robots perform up to four tasks: welding, riveting, bonding, and installing a component. Eight robots might work on a single car at each station of the assembling line in a choreographed pattern like ballet. The robots produce up to 83 cars a day, and can be reprogrammed to produce the Model X on the same assembly line.

Distribution

Musk saw the franchise-dealership arrangements that U.S. car companies use to sell cars as an expensive, margin-killing model. He chose instead to own and operate Tesla dealerships himself (a controversial move that has provoked the ire of dealership networks). Furthermore, Tesla dealerships are more like “stores” in upscale shopping malls (in 2013 the company had 35 stores across the U.S., Europe, and Asia). Salespeople answer customer questions without using high-pressure sales tactics. The company also sells direct to consumers on the internet.

Marketing

Tesla spends no money on advertising, nor does it have any plans to hire advertising agencies or run ads in the future. Its in-house marketing team had only seven staff people, and an internal team runs the website. Nissan, by contrast, spent \$25 million advertising the Leaf in 2012. According to Alexis Georgeson, Tesla spokesperson, “Right now, the stores are our advertising. We’re very confident we can sell 20,000-plus cars a year without paid advertising . . . It may be something we’ll do years down the road. But it’s certainly not something we feel is crucial for sales right now.”

Looking to the Future . . .

In the first quarter of 2013, Tesla announced its first quarterly profit. The company had taken in \$562 million in revenues, and reported an \$11.2 million profit. Then more good news came: the Model S had earned Consumer Reports’ highest rating, and had outsold similarly priced BMW and Mercedes models in the first quarter.^{xviii} In May of 2013, the company raised \$1 billion by issuing new shares, and then surprised investors by announcing that it had paid back its government loan. After repaying the loan, Tesla had about \$679 million in cash. Musk had announced confidently that he felt it was his obligation to pay back taxpayer money as soon as possible, and that the company had sufficient funds now to develop its next generation of automobiles without the loan, and without issuing further shares.

Tesla’s success was surprising and inspiring. The company had survived its infancy, appeared to be solvent, and was meeting its sales objectives even though serious obstacles remained for electric vehicles. It was also competing against companies with far greater scale. As noted by O’Dell, a senior editor at auto information sites Edmunds.com, on Tesla’s success, “A lot of people have been very, very skeptical . . . when you want to be an automaker, you are competing with multibillion-dollar conglomerates . . . It’s entrepreneurship on steroids . . . They had a huge learning curve but they’ve powered through it.” Theo O’Neill, an analyst at Wunderlich Securities adds that “It’s going to prove everybody in Detroit wrong . . . They all say what Tesla is doing isn’t possible.”

However, some investment analysts were more skeptical. The 2013 profits had included a one-time \$10.7 million DOE stock warrant profit, and \$68 million in ZEV credit sales. The warrant revenues would not be repeated, and nobody knew what the yearly demand for ZEV credits would be and whether such revenues were sustainable. Competition from the major automakers was also increasing steadily. Furthermore, what was the true market size for electric vehicles, and what portion of that market would pay the higher price of a Tesla? On top of this, Tesla's stock had risen meteorically and many investors were concerned that Tesla's stock price was an overinflated bubble (see Figure 3). In June of 2013 Tesla's market capitalization was \$11 billion—more than Fiat's and roughly a quarter of General Motors. While Tesla's success surely warranted praise and enthusiasm, it was difficult for many people to reconcile such a large market capitalization with Tesla's sales. Furthermore, if the stock was overvalued and began to drop precipitously, it could undermine people's faith in the company. In short, Tesla was not out of the woods yet.



Source: Nasdaq.com

Exhibit 1**Tesla Financials, in Thousand US\$**

	March 2013	2012	2011	2010
Revenues				
Automotive sales	555,203	385,699	148,568	97,078
Development services	6,589	27,557	55,674	19,666
Total revenues	561,792	413,256	204,242	116,744
Cost of revenues				
Automotive sales	461,818	371,658	115,482	79,982
Development services	3,654	11,531	27,165	6,031
Total cost of revenues (1)	465,472	383,189	142,647	86,013
Gross profit	96,320	30,067	61,595	30,731
Operating expenses				
Research and development (1)	54,859	273,978	208,981	92,996
Selling, general and administrative (1)	47,045	150,372	104,102	84,573
Total operating expenses	101,904	424,350	313,083	177,569
Income/Loss from operations	-5,584	-394,283	-251,488	-146,833
Interest income	10	288	255	258
Interest expense	-118	-254	-43	-992
Other income (expense), net (2)	17,091	-1,828	-2,646	-6,583
Income (loss) before income taxes	11,399	-396,077	-253,922	-154,155
Provision for (benefit from) income taxes	151	136	489	173
Net income (loss)	11,248	-396,213	-254,411	-154,328
Net income (loss) per common share, basic (3)	0.1	(3.69)	(2.53)	(3.04)