

In a dressing room above the “Late Show with David Letterman” stage, the electric-car magnate Elon Musk sat on a sofa, eating cookies. Three of his employees hovered around him anxiously. Musk, thirty-eight, is the chairman, C.E.O., and product architect of Tesla Motors, and he was appearing on Letterman to show off the company’s newest design: a sleek sedan called the Model S. Tesla plans to have the vehicle in production by 2011—at which point, if you believe Musk, gasoline-powered cars will suddenly look like oxcarts.

On this April day, he was wearing black half-boots and a gray hacking jacket. The curious apparel, together with his Pee-wee haircut, glowing blue-green eyes, South African accent (he was born in Pretoria), and manifest determination to save the world—single-handedly, if necessary—conspires to make him seem somewhat alien. He’s the mysterious visitor who skims down the ramp, eager to help.

After co-founding the Internet startups Zip2 and PayPal, when he was in his twenties, in 2002 Musk launched the Space Exploration Technologies Corporation (SpaceX), with the ultimate goal of colonizing Mars; the company recently won a \$1.6-billion contract with NASA to resupply the Space Station. He is also the leading investor in and chairman of SolarCity, a solar-panel-installation company run by two of his cousins. And in 2004 he provided Tesla with its initial funding, in the belief that electric vehicles, or E.V.s, together with solar power, will help wean the world off oil, buying us time to address global warming (and colonize Mars). “The likelihood of humanity gaining a true understanding of the universe is greater if we expand the scope and scale of civilization, and have more time to think about it,” he told me. “We’re like a giant parallel supercomputer, and each of our brains runs a piece of the software.”

Musk’s goal for the Letterman show was to demystify electric cars, and to explain how he’s going to fix Detroit from his headquarters, in Silicon Valley. His employees were with him to make sure he didn’t come across as a total geek. They peppered him with talking points, most of which he seemed to ignore. His

LETTER FROM CALIFORNIA

## PLUGGED IN

*Can Elon Musk lead the way to an electric-car future?*

BY TAD FRIEND



*Musk and his children with a clay model for the Model S in the Tesla Design Center, at SpaceX.*



*"The Model S is a great car," he says. "It's just a giant version of what you have in a laptop." Photograph by Martin Schoeller.*

assistant, Mary Beth Brown, told him, "And don't be all engineering, all It requires twenty-five times the energy to get to orbit that it does to get to space."

"Most people think gravity ends when you get two hundred miles above the earth," Musk observed, adding, "Most people don't know much."

It troubles Musk that while few people know that the world's oil supply could plateau by 2020 and run out as early as 2050, nearly everyone knows that electric cars suck. For decades, E.V.s resembled hovercraft or mobile eggs, and their lead-acid battery packs were costly, heavy, and sickly. After investing more than a billion dollars, G.M. in 1996 launched the EV1, an electric subcompact that it leased to several hundred customers in California and Arizona. In 2003, the company began retrieving the cars and crushing them for scrap. The EV1, which could go only about seventy-five miles before needing to be charged, embodied the perennial problem of "range anxiety": if your battery ran down far from home, where would you recharge it?

Last fall, Tesla began making the only highway-capable E.V. now available: the Roadster, a \$109,000 sports car

that goes from zero to sixty in less than four seconds and has a range of two hundred and forty-four miles. Powered by a lithium-ion battery—the kind used in laptops and cell phones—the Roadster was designed to prove that E.V.s can not just compete but excel. (Lithium is lighter than lead and releases a lot more energy.) Having gained "first-mover advantage"—which is particularly prized in Silicon Valley—Musk plans to cut the price for each of Tesla's succeeding models more or less in half and seize the market from the top down. Bob Lutz, the vice-chairman of G.M. and the champion of its electric Chevy Volt, which will debut next year, told me, "All the geniuses here at General Motors kept saying lithium-ion technology is ten years away, and Toyota agrees with us—and, boom, along comes Tesla. So I said, 'How come some teeny little California start-up run by guys who know nothing about the car business can do this, and we can't?' That was the crowbar that helped break up the logjam."

So far, Tesla has built just six hundred cars, or .000002 per cent of the country's two-hundred-and-fifty-million-car fleet, but the Roadster can be found in the multicar garages of

George Clooney, Matt Damon, Leonardo DiCaprio, the Google founders Sergey Brin and Larry Page—and David Letterman.

Musk has five hundred employees at Tesla, and they have faith in his abilities as an engineer and an entrepreneur. But some worry about his aptitude for the most difficult part of the job: selling cars. At an unveiling of the Model S for Tesla's employees, in Menlo Park, California, Musk read from a PowerPoint presentation, adding his own taglines a beat late: "What's cooler than making a hot product, a sexy product, that also saves the world!" Pause for applause; not forthcoming. "And also makes money, meeting third-quarter targets!"

In the studio, Brown looked at Musk affectionately, seeming to wonder how to imbue him with the Steve Jobs touch. She warned him, "If you call Dan Neil a douche bag on national television, I'm going to come out and kick your ass."

"But he is a douche bag!" Musk protested, half-seriously. Neil, the Los Angeles *Times*' car columnist, had that morning published a caustic piece calling the Model S "a glorified golf cart," after he'd driven the company's pre-prototype "show car"—a kind of dynamic sketch that lacked windshield wipers and operable windows. And Musk tends to blast journalists who don't see things his way. In early April, he had told an interviewer that Randall Stross, who had written negatively about Tesla in the *Times*, "is a huge douche bag, and an idiot."

Musk was predisposed to be vexed by the Neil article, because, as he'd told me earlier that day, Tesla was about to recall most of its Roadsters to fix some loose bolts in the wheel hubs. "It's bloody Lotus's fault," he said, referring to the British carmaker, which manufactures the Roadster's chassis, "but it'll be seen as 'Tesla, the upstart car company, doesn't know how to make cars.'"

"Then there's my own profile," Musk said, referring to Silicon Valley gossip sites such as Valleywag.com, which have portrayed him as paranoid and despotic. A prophet is not without honor, save in his own valley. "The people who know me generally have a good impression. Generally, if I didn't fire them"—he laughed—"then they have a good im-



*"Well, why can't you be more like a quiet woodland stream filled with trout?"*

pression.” He fell silent for two minutes, processing. Then he announced, “I’m going to call Dan Neil and say, ‘What the fuck?’ Starting with a negative conclusion and backfilling the facts is a classic dickhead move—and a classic human fallacy.” Humans!

As a boy in Pretoria, Musk was undersized and picked upon, a smart-aleck known as Muskrat. In his loneliness, he read a lot of fantasy and science fiction. “The heroes of the books I read, ‘The Lord of the Rings’ and the ‘Foundation’ series, always felt a duty to save the world,” he told me.

When Musk was eight, his parents divorced, and he and his two younger siblings lived with their mother and a series of nannies in a succession of South African cities. “I think my mother somewhat overstates her role in raising me,” Musk says dryly. Maye Musk, a Canadian-born model and dietician, says, “Elon would accompany me to dinner parties if I didn’t have a date. I’d bring him to meet some interesting adults, and he’d hide a book under the table to read if they weren’t interesting enough.”

When he was eleven—about the time that he sold his first piece of software, a video game called *Blastar*—Musk told his mother that he was going to move back to Pretoria to live with his father, Errol, an electrical engineer who would later own an auto-parts store and a share in an emerald mine. “You have three kids and Dad has no kids,” Musk explained. (“My father is not a fun guy to be around, but it seemed like the right thing to do,” he told me.) He hoped that his father would move with him to America, where he’d once taken him on a visit. America was comics, movies, technology—freedom. When that plan failed, Musk immigrated to Canada on his own, at seventeen. There he floated among his mother’s cousins’ houses, often living on a dollar a day and buying hot dogs and oranges in bulk. He spent two years at Queen’s University in Ontario, then finished up at the University of Pennsylvania, where he earned bachelor’s degrees in physics and economics, with an unofficial minor in first-person-shooter video games.

In 1995, Musk dropped out of a Ph.D. program at Stanford after two



“Could we have some conviviality over here?”

days in order to explore opportunities on the Internet; four years later, he sold Zip2, a newspaper-hosting platform he’d built with his brother, Kimbal, and netted \$22 million. He promptly founded a company that became part of PayPal, and cashed out with \$160 million when eBay bought PayPal, in 2002. Then he began thinking about what to do next. George Zachary, a venture capitalist and a friend of Musk’s, remembers, “Elon called me up and said, ‘Do you think people would think I’m crazy if I sent mice to Mars?’ I said, ‘Do they come back?’ and he said, ‘I don’t know.’ I said, ‘Well, if they don’t come back, yes.’”

Musk founded SpaceX in 2002. Last fall, its Falcon 1 rocket became the first privately funded liquid-fuelled rocket to achieve orbit—after three failed launches, including that of a rocket containing the ashes of James Doohan, who played Scotty on “Star Trek.” (Musk says, “Technically, Scotty’s ashes did get to space, they just didn’t stay there.”) The company’s larger Falcon 9 will soon begin to resupply the Space Station, and Musk expects that the craft will be ferrying tourists into space by 2014, looping them around the moon for fifty million dollars a head.

Two years before founding SpaceX, Musk married Justine Wilson, a writer of fantasy novels he’d met at Queen’s

University. The couple went on to have twins, followed by triplets; they separated last year. “Elon’s central relationship is with his work,” Justine Musk says, and Musk acknowledges that when problems began to multiply at Tesla, in 2007, “I went from working hard to working ridiculously hard. And stress breaks things.” Shortly after the couple parted, Musk met the English actress Talulah Riley, and proposed to her. Musk and Riley plan to have children, too, though Musk says his reasons differ somewhat from hers: he believes it’s the duty of the intelligent and educated to replicate, “so we don’t devolve into a not very literate, theocratic, and unenlightened future.” As part of his program for *Homo sapiens*, the beta version, he reminds unfruitful employees, “You should have, on average, 2.1 kids per woman.”

In 2004, Musk, who was interested in developing an electric car, met an engineer named Martin Eberhard, proposed to build a sports car with a lithium-ion battery. Musk agreed to underwrite the company, and he and Eberhard planned to release the Roadster within two years, at a development cost of about \$25 million. It took four and a half years and \$140 million. Eberhard wanted to get the first Roadster out fast, by placing an electric power



train in a modified Lotus Elise chassis. Musk believed that the first Roadster had to impress—which meant that it had to have, among several expensive and time-consuming changes, a carbon-fibre body and the ability to reach sixty miles per hour in less than four seconds. (Musk denies that the changes burdened the company.) He also insisted that they focus on future models. “He’d say, ‘We’re going to be the next G.M.,’ and talk about putting a hundred thousand cars on the road by 2009,” Eberhard recalls.

Tesla’s chief technology officer, J. B. Straubel, says, “We hugely underestimated the challenge—the complexity of supply chains, of manufacturing, of the battery design. It was like working through a maze.” The Roadster’s battery is a highly engineered arrangement of six thousand eight hundred and thirty-one finger-size laptop cells imported from Japan. Tesla adds two fuses to each cell so they’re all triple-fused, packs them in six hundred and twenty-one cell modules, maintains the modules at a constant temperature with radiator coolant, and monitors them with twelve computers, then houses this amphibious latticework in a thick aluminum case shaped like a baby grand piano. The unit weighs half a ton.

Musk and Tesla’s board of directors pushed Eberhard out in 2007, as it became evident, just months after the company estimated the cost of produc-

ing the first Roadsters at \$70,000 apiece, that the figure would actually be a crippling \$130,000. (In May, Eberhard filed a lawsuit against Musk and Tesla, claiming that Musk had slandered him by calling him deceitful and had stolen the credit for founding Tesla; in a rebuttal on Tesla’s blog, Musk argued that “it would have been forgivable if Eberhard had simply been in over his head,” but that Eberhard had sought to keep the cost overruns from the board. Musk says that the parties are now considering mediation.)

Musk tried out two other C.E.O.s. Yet he also kept doubling his bet, putting up a total of \$75 million of the company’s first \$195 million. (He eventually invested ninety per cent of his net worth in Tesla, SpaceX, and SolarCity.) Last fall, he backed his money with a resource even more precious to him: his time. He took the job of C.E.O. himself, and immediately began focussing on price and profit. Relying in part on the fact that the storage density of lithium-ion batteries is increasing about eight per cent a year, and costs are dropping correspondingly, Musk recently vowed that Tesla will offer a third-generation car for less than thirty thousand dollars by 2014. Straubel says, “As the company has matured, it has become more of a worthy adversary for Elon. He constantly wants everything we’re doing to be really difficult, but he works really hard to make sure it’s not impossible.

He almost won’t let us fail.” Justine Musk observes, “I like to compare him to the Terminator. He sets his program and just . . . will . . . not . . . stop.”

As new-car sales in America are expected to fall to ten million this year, down from sixteen million in recent years, and as Chrysler and G.M. struggle after sojourns in bankruptcy, the big automakers are, often reluctantly, developing E.V.s of their own. Ford plans to release the electric Focus in 2011, and Chrysler says it will have five hundred thousand electric cars on the road by 2013, under its new ENVI brand, aimed at “consumers who care about the planet’s future.” (For everyone else, there’s the Jeep Wrangler Unlimited.) Renault, Nissan, and Mitsubishi are soon to release electric models, and the Chinese government, in a bid for its manufacturers to dominate the market, is setting up battery-charging stations in some of its largest cities and offering fleet owners who buy E.V.s and hybrids subsidies of up to eighty-eight hundred dollars.

But the American car buyer’s default vehicle is a twenty-thousand-dollar sedan—and that equation doesn’t work yet for E.V.s. The Roadster’s power train alone costs about fifteen thousand dollars to manufacture, five times what it would cost for a standard car. So a number of automakers have sought cheaper electric options. G.M.’s Volt, for instance, is a “plug-in series hybrid.” For longer journeys, a four-cylinder engine will kick in and repower the battery, but most trips will call solely on the battery, which has a range of about forty miles. (Nearly eighty per cent of Americans drive fewer than forty miles a day.)

A number of analysts see plug-ins as offering customers the best of both worlds: conspicuous greenness backstopped by the good old internal-combustion engine. And most E.V. manufacturers embrace the idea of competition, believing that the more E.V.s that enter the market the more consumers will believe that the concept, finally, isn’t going to go away. Nonetheless, Musk can’t help pointing out that in his view the Volt is an inelegant compromise; its battery pack is nearly half as large as the Roadster’s but has only one-sixth the electric range. After the Volt’s battery runs down, Musk says, “You’ll

have a tiny engine pulling around a big car with a dead battery—you'll be the worst car on the road."

In New York, when Musk got onstage with David Letterman, he perched awkwardly in his chair, half-turned toward the host, who was fighting a cold and was in a particularly sardonic mood. Letterman began a rant about how Detroit's failure to produce electric vehicles had ruined the country's economy, and how the Volt "has a range of forty miles"—a characterization that ignores the repowering provided by the gasoline engine, but one that Musk didn't correct. "That's crap!" Letterman growled. After the Model S was brought out from backstage, to oohs from the audience, Musk elicited applause when he noted that it would cost only \$49,900 (after a \$7,500 federal tax credit). As Letterman began to step into the car, Musk twice said, "There's one very important point worth making"—intending to explain that recharging with electricity, at the equivalent of roughly forty-five cents a gallon, turns the S into a thirty-five-thousand-dollar car (if you amortize costs over seven years)—after which he'd deliver his kicker: "So would you rather have this car, or a Ford Taurus?"

But Letterman grabbed the car's steering wheel and began flailing around and screaming, pretending that he was being electrocuted. Musk grinned gamely; interview over. Three weeks later, G.M.'s Bob Lutz went on the "Late Show" to correct the record on the Volt. He was allowed several minutes to make his points—and then Letterman grabbed the steering wheel of the Volt prototype and began flailing around and screaming.

In late March, Tesla unveiled the Model S at a cocktail party on friendly turf: SpaceX's headquarters, next to a local airport in Hawthorne, south of Los Angeles. Techno music throbbed as the hangar filled with some five hundred guests—a Bluetooth-sporting, leather-jacket-wearing crew that included the producer Joel Silver, the director Jon Favreau, and the agent Ari Emanuel, who has reserved four of the cars. Twenty Roadsters sat in rows outside, their vanity plates a chorus of ecójubilation—EV 2, AC POWR, CYA OPEK. The air was tangy with jet fuel and Eau Sauvage.

Anthony Kiedis, the lead singer of the Red Hot Chili Peppers, was telling Musk that the only problem with his Roadster was that "now I never drive my other car"—a Porsche. Rick Rubin, the co-head of Columbia Records, told me, "I want to be a Tesla owner, but when my friend"—he nodded at Kiedis—"tried to pick me up tonight it was painful." Rubin is a distinctly burly man, but many people have found that leveraging themselves into the Roadster's low cockpit calls to mind a prison break through a ventilation shaft. Rubin said that he was going to put down a deposit for the roomier Model S: "The quiet feels really good, just taking off without a sound."

When Musk slipped the silk cover off the show car, the crowd surged and cell-phone cameras flashed. "This car is going to show what's possible with electric vehicles," Musk promised. "You can fit a surfboard, a fifty-inch TV, and a mountain bike—at the same time." There were gasps. Praising the car's cornering, he boasted, "You'll need a spatula to flip this thing over." And with Tesla's planned QuickCharging—stations that the company intends to place at highway rest stops, where you'll be able to recharge your battery in forty-five minutes—"you could start here at breakfast and be halfway across the country by dinnertime."

For now, if you plug your Roadster into one of Tesla's seventy-ampere wall boxes (which the company will install in your garage for three thousand dollars), it takes nearly four hours to recharge the car completely. When I plugged a Roadster I was test-driving into a standard outlet in my sister's garage, its battery gained only nine miles in two hours. (However, as long as cars are "trickle charged" during off-peak hours, the current grid will be able to handle charging about a hundred and seventy-five million E.V.s.)

When I asked Musk how you could possibly get your Model S halfway across the country before dinnertime, we got into a back-and-forth that included discussion of higher speeds draining the battery faster because the drag increases with the square of the velocity; a possible anode change in the battery cells from graphite to silicon; the daunting logistics of charging an E.V. in the five minutes it takes to gas up a conventional car (it would require an eight-hundred-and-forty-kilowatt connection, which would drain the grid as much as a one-hundred-unit apartment building does in the course of a day)—and, on my end, such considerations as the country's width, and how often people need to eat and visit the bathroom, and the speed limit. "In a twenty-four-hour period," he finally suggested, "you



*"Actually, it's pronounced 'An-hel.'"*

could get halfway across the country, how about that?"

"Using the highway charging stations that haven't been built yet?" I said.

"Right!"

Musk longs to engage people in the mechanics of the constructed world. So when Governor Arnold Schwarzenegger made a late appearance at the launch party, Musk gave him a thorough tour of the car, detailing the location of the battery pack in the floor pan, the eventual rear-facing child seats, the electronic cutoff that caps the speed at a hundred and thirty miles per hour. "Huh," Schwarzenegger said. The Governor slid into the driver's seat and stretched appreciatively (having returned his Roadster because it constrained his mighty deltoids). He swiped a hand across the seventeen-inch dashboard computer. "Haptic screen," Musk said, leaning in. "Digital wireless as well. You can actually browse the Internet and see the Google Maps fly." Schwarzenegger held a pose of keen interest as photographers and videographers jostled for the shot.

"He has no technical understanding whatsoever," Musk said later, with a trace of disappointment. "But he's become very pro-environment—he made a deposit on a Model S." Meanwhile, after his cameo, Schwarzenegger rolled off in a convoy of sixteen-mile-per-gallon Yukon XLs.

Musk spends half the week at SpaceX and half at Tesla, which is headquartered in San Carlos, California. He bounces from meeting to meeting, never taking notes, nodding briskly as he caches information with a kind of sleep-deprived alertness. In early April, during Tesla's weekly executive staff meeting, Mike Donoughe, a Chrysler veteran, mentioned that a murky set of administrative problems at BorgWarner, the company's transmission supplier, was delaying Roadster production. Tesla needed an uninterrupted flow of cars to boost its thin cash reserves and shaky reputation for dependability, but Donoughe's verdict was gloomy: "If we can get eighty cars to customers this month, it would be a home run, but we're looking more at sixty-five, seventy."

## IF A CLOWN

If a clown came out of the woods,  
a standard-looking clown with oversized  
polka-dot clothes, floppy shoes,  
a red, bulbous nose, and you saw him  
on the edge of your property,  
there'd be nothing funny about that,  
would there? A bear might be preferable,  
especially if black and berry-driven.  
And if this clown began waving his hands  
with those big white gloves  
that clowns wear, and you realized  
he wanted your attention, had something  
apparently urgent to tell you,  
would you pivot and run from him,  
or stay put, as my friend did, who seemed  
to understand here was a clown  
who didn't know where he was,  
a clown without a context?  
What could be sadder, my friend thought,  
than a clown in need of a context?

Musk frowned. "This is life or death for us—if BorgWarner doesn't deliver on time for more than a month, we're dead. Don't shield me from emergencies. I want to know the split second they occur, and have the option of taking a hand." The other executives bent over their notes, eyes averted.

"We believed we had it managed better than we did," Donoughe said.

"Because we're teed up to have a profitable third quarter, before Model S expenses start becoming significant," Musk continued. "So we need to make those cars, deliver them to customers, and have them work. Crazy." Everyone laughed, nervously.

After the meeting, Musk called the head of transmissions at BorgWarner to underscore the seriousness of the problem. Then he sent two employees from Tesla's office in Auburn Hills, Michigan, to BorgWarner's offices, nearby. "Tell them you're here to help," he said. "Be polite but immovable. And, unless the security guard throws you out, they will find the parts you need." The parts appeared, and Tesla delivered eighty-four cars in April.

Musk told me, "It's ironic that we're being held up once again by the incum-

bent technology—the transmission—not the new one, the battery." BorgWarner is the company's third transmission maker. Marc Tarpenning, a Tesla co-founder, says, "We learned that the car industry is unbelievably good at delivering what they've done in the past with a little tweak—faster, or in yellow. But if you want something a lot different—a simplified transmission that's electrically actuated—that's too radical. The designers and engineers who can do radical changes all left Detroit forty years ago."

Silicon Valley's E.V. entrepreneurs portray their technology as a fundamental discontinuity, a break from Detroit's hidebound traditions. Yet, at the turn of the twentieth century, electric vehicles outsold all other types of cars. "Electric Road Wagons" and "Electrobats" were popular with women, because, unlike gas-powered vehicles, they required no strenuous cranking to start. (The Columbus Buggy Company proclaimed, "A delicate woman can practically live in her car yet never tire.") Cars with internal-combustion engines gradually took over, because they were easier to refuel and they cost less, as Henry Ford's assembly-line breakthroughs made his

If then the clown said to you  
 that he was on his way to a kid's  
 birthday party, his car had broken down,  
 and he needed a ride, would you give  
 him one? Or would the connection  
 between the comic and the appalling,  
 as it pertained to clowns, be suddenly so clear  
 that you'd be paralyzed by it?  
 And if you were the clown, and my friend  
 hesitated, as he did, would you make  
 a sad face, and with an enormous finger  
 wipe away an imaginary tear? How far  
 would you trust your art? I can tell you  
 it worked. Most of the guests had gone  
 when my friend and the clown drove up,  
 and the family was angry. But the clown  
 twisted a balloon into the shape of a bird  
 and gave it to the kid, who smiled,  
 let it rise to the ceiling. If you were the kid,  
 the birthday boy, what from then on  
 would be your relationship with disappointment?  
 With joy? Whom would you blame or extoll?

—Stephen Dunn

cars cheap enough for nearly everyone. Walter Flanders, the efficiency expert behind Ford's Model T, observed, "Henceforth the history of the industry will be the history of the conflict of giants." Over the decades, E.V.s surfaced as an occasional curiosity, but the memorable challenges to the giants were posed by engineers from Detroit, including Preston Tucker, in the nineteen-forties (whose eponymous sedan showcased disk brakes and a rear-mounted engine), and John DeLorean, in the nineteen-eighties (whose eponymous sports car had gull-wing doors and travelled through time in "Back to the Future"). Both companies were unable to scale up production and quickly collapsed. Tucker built only fifty-one cars.

**E**. V. devotees like to point out that electricity is everywhere, and that the country has more than a billion outlets. But many of those are tucked away behind sofas. What's more, many drivers park on the street: building a recharging infrastructure for them, one that feels as ubiquitous as the country's hundred and sixty thousand gas stations, will pose an expensive challenge. Mark Duvall, the director of electric

transportation at the Electric Power Research Institute, says, of the cost of building charging stations, "If you want to use E.V.s to drive between cities, we're probably into the hundreds of billions."

Undeterred, Shai Agassi, a forty-one-year-old software whiz from Israel, plans to build a huge charging network. Agassi's marketing hook is an insistence that E.V.s are just like cell phones: while people like Musk build the phone, Agassi is going to build the network. He'll own your car's battery, and you'll pay only for the miles you drive with it. Two years ago, Agassi founded Better Place, a Silicon Valley-based company that intends to supply customers with E.V.s, built by Renault-Nissan; charging posts; and battery-switching stations for use on long trips. His first network is taking shape in Israel: before Renault's E.V.s arrive there, in 2011,



Better Place is working to install a hundred thousand charging posts and build a hundred battery-switching stations, where a giant robotic arm will pull out your depleted battery and replace it with a charged one in less than a minute. He plans similar networks in Denmark, Australia, Hawaii, and Northern California, expanding centers of E.V. support to eventually cover the world.

Musk and Agassi would seem like natural allies, yet each is keenly aware of history's parsimony in recognizing pioneers. Agassi, who is trim, suave, and as relentless as a woodpecker, says of Musk, "Elon made the best car in the world, which is fantastic. But we're going to make the cheapest. Cheap wins." He explained that by 2020 the cost of an "electric mile" will be so negligible that you'll essentially be buying or leasing your E.V. (minus the battery, which he owns) for about the cost of what you used to pay each year for gas. "You can't solve the world's climate problem with two hundred and fifty expensive cars—you need seventy million a year," Agassi says. "It's the difference between building a small device that connects to your TV, called Minitel, or building the Internet. We went out to do the Internet. This is iPod, this is Ford Model T, taking eighty per cent of the market." He drew a graph, one of many he plotted as we talked. "You've got to focus on the twenty-five per cent of cars that drive twenty-K plus a year and emit sixty-six per cent of the emissions." He inked in dots and vectors. "To do that group, you've got to have battery exchange—and you have to give the car to them for free, because they're the average Joes who buy clunkers, drive them a lot every day, and consume them to the end. Forget about these guys"—Agassi gestured to where forty per cent of the cars lay, those which drive fewer than six thousand miles a year—"the George Clooneys and Leo DiCaprios. They give you a lot of publicity, but Leo doesn't drive a lot of miles."

Agassi's projections for the price of electricity and E.V.s in the coming years are aggressive; the main problem he faces, though, is persuading manufacturers other than Renault to build E.V.s with batteries that are easy to detach and exchange. None of the auto executives I spoke with expressed any

inclination to build their cars to suit Better Place. They had liability concerns about swapping, and proprietary concerns about their battery's design. Herbert Kohler, the vice-president for E-Drive and Future Mobility at the German automaker Daimler A.G., said tartly, "A standardized battery would have to result from a standardized car, and a standardized car didn't work under socialism in the G.D.R."—East Germany.

Just in case Agassi turns out to be right, Musk has decided to make the Model S's battery swappable. (The swap won't take place at Better Place stations, though; Agassi told me that he would stock batteries only from large automakers.) But Musk says that battery swapping won't really be necessary. Powerful batteries will allay most people's range anxiety, and innovation will make charging fast—or at least fast enough for people to do it while they grab a bite. "Don't build unicorn pastures until there are some unicorns," he said. "I think Shai is going to spend a lot of money and not have a lot to show for it." Still, Musk worries that the course of E.V. adoption may be determined less by the pertinent data than by personal magnetism. He noted, ruefully, "Shai is very charismatic and natural in

group settings, so his information is always going to seem overimpressive, whereas mine seems underimpressive."

In early April, Tesla threw a cocktail party at the National Building Museum, in Washington, D.C., to show off the Model S to the only venture-capital firm worth hitting up these days: the federal government. (The Department of Energy alone is giving \$27.4 billion in loans to improve fuel economy and encourage the nascent E.V. industry.) Partygoers could ride in the Model S around a sort of giant indoor slot-car track, at speeds of up to thirty-two miles an hour. They could also ride in the Roadster, but only outside, in the rain; when Musk was planning the party with Mary Beth Brown, he told her, "The Roadster hurts us in Washington—we want to deemphasize it. We don't want to give the sense that this is about toys for rich people."

Diarmuid O'Connell, a former State Department official who acts as the company's government liaison, was button-holing members of Congress and their aides, hitting Tesla's themes: environmentalism, of course, but also patriotism (innovation defines America); the economy (breakthroughs like the Model S will lift us out of the recession; we trans-

fer trillions of dollars to the Middle East for oil); and national security (our dependence on oil compromises our foreign policy). When Thomas (Mack) McLarty, President Clinton's first chief of staff, emerged from the Model S, O'Connell brought him over to meet Musk, who was wearing a gray suit to fit in. McLarty, whose McLarty Companies owns ten car dealerships, cried, "This is exciting!" Musk gave a vigorous nod, and stood ready to field questions. But that was it.

"Elon's a wealthy, passionate, iconic figure, and it's a fascinating vision," McLarty told me, after he'd moved off. "But he's an independent producer, and my generation saw the DeLorean."

Musk took the microphone and addressed the crowd, ticking off the Model S's qualities. Afterward, he greeted Senator Maria Cantwell, of Washington, who chairs the Senate's energy subcommittee, and asked, "Did you hear my sales pitch?"

"Um, no. But I took your car for a little spin," Cantwell said noncommittally. Musk instantly launched into his latest version of the pitch: "The Roadster is a good car. The Model S is a great car. It's just a giant version of what you have in a laptop. The motor is only nine inches in diameter—you can actually pick it up"—and he was off, talking for four minutes as Cantwell waved at passing acquaintances over his shoulder. "The gear ratio allows more torque, yet the center of gravity is super low, and the battery being in the floor pan allows us to fit seven people—"

Cantwell patted Musk's hand. "Thank you!" she said, gliding off. O'Connell stepped in to debrief her, and she asked, "Why don't you do a minivan?" O'Connell explained that Tesla had struck out with Lou Rhodes, the president of the ENVI program at Chrysler, when it proposed building an electric power train for one of the automaker's minivans. Cantwell shook her head: typical. (When I followed up with Rhodes, he said, "Chrysler *owns* the minivan market, and we will stand alone on our minivan strategy going forward.")

Cantwell told me that she was concerned that while the Big Three struggle to stay in business China already has two hundred and fifty companies working to build batteries and electric cars and charging infrastructure. "Getting



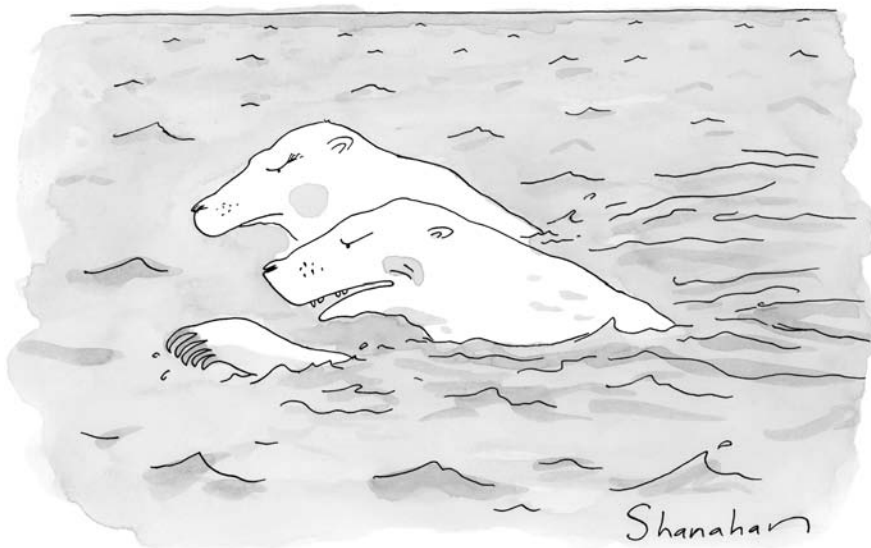
*"A pillar of salt? Why, you poor, poor man."*

denser, more affordable batteries built here is the whole game,” she said. “Otherwise, we’re soon going to be as dependent on Chinese batteries as we are now on Middle East oil.” But Cantwell acknowledged that there is no political will in Congress to prod consumers to switch to electric by taxing gasoline heavily, as is done in Europe.

Mike Carr, the legal counsel for the Senate Energy and Natural Resources Committee, was also at the party. He said that Senator Jeff Bingaman, of New Mexico, who chairs the committee, had a bill that would introduce a “feebate” on cars according to their energy efficiency: gas guzzlers would be taxed and E.V.s would get a rebate. (The bill was introduced in the Senate in early August.) “But the automakers, while saying they favor gasoline taxes, oppose the idea—which essentially front-loads the cost of a gas tax into the purchase price—because they think it would make their cars more expensive now,” Carr said. “These days, the auto industry is rarely in the position to be able to think long term.”

At times, between meetings, Musk finds himself daydreaming about building a supersonic electric airplane, or a double-decker highway. Then he catches himself, with a start, and gets back to work. In April, just after resolving the transmission-delivery snafu, Musk met with Deepak Ahuja, Tesla’s C.F.O. Ahuja told him that by July the production cost of the Roadster would drop to eighty-two thousand dollars, making the company’s margin more than thirty per cent on each car. (The company wound up making its first monthly profit in July.) Ahuja went on, “We’d projected we’d be at three million dollars in Model S reservations by the end of March, and we’re at seven million a week later. So we’re exactly double.”

Musk spun in his chair like a boy. “Not bad! Not bad for the worst automotive environment since the Great Depression, all the stories about Tesla supposedly going bankrupt, people’s net worth having taken a giant kick in the balls, and the fact that the car isn’t coming out for two and a half years.” And in May, in an important vote of confidence, Daimler A.G. bought nine per cent of Tesla, for fifty million dollars—even as



*“And when you are in the mood there’s never any goddam ice!”*

it was relinquishing a twenty-per-cent stake in Chrysler, which it had owned entirely as recently as 2007. “Tesla enables us to skip a generation and get into electric as fast as possible,” Daimler’s Herbert Kohler told me.

In the ensuing months, however, as Musk shifted his focus to wooing the Department of Energy—which in late June extended \$465 million to the company, to build two factories—and to getting the Roadster’s 2.0 version out the door, the pace of Model S reservations fell markedly. Winning hearts and minds is a slog. G.M.’s Bob Lutz, who spoke with me on the day that his company announced it was closing thirteen plants and dropping its Pontiac brand, observed that first-mover advantage gets you only so far. “The hubris of Tesla is ‘We’re not going to fall into the trap of being like Detroit—we’re going to be the Silicon Valley guys, nimble and innovative,’” Lutz said. “Everyone who tries to reinvent this business believes that auto companies are populated by dummies who don’t understand Moore’s Law. But, unlike a silicon chip, the modern automobile has to be a certain size, and carry a certain number of people, at a certain speed. Over thirty-five hundred parts sourced from around the world have to come together at the right place and the right time to produce sixty to seventy of these things an hour. These things are called cars. And to make them you need

a large engineering staff, a workforce that demands retirement benefits, a tax staff, a fleet of accountants, and an unbelievable amount of reliability testing that Tesla can’t afford to do right now—and we can’t afford not to do. Inevitably, Tesla will discover that the only way to succeed on the scale we have is to be exactly like us.”

Although more than a quarter of Tesla’s employees come from the Big Three, and although the company has begun to cultivate the Stakhanovite mind-set necessary for mass production, Musk argues that Tesla is nothing like G.M., and never will be: “We’re still very little, and so while the big automakers won’t be afraid of us, they should be afraid of their competitors imitating us. Our success will make Toyota worry about what BMW will do, and G.M. worry about Honda—will create a concern about being late for the party. So our role is as a guiding light, helping bring these cars to market five or ten years faster than they would have otherwise—which could make an important difference for saving the species.” He closed one eye to gaze at the ceiling and beyond, calculating. “Still,” he added, “we could be selling a million cars a year in ten years. That seems doable.” That would require Tesla to increase its current production a thousandfold. It would also be more cars than G.M. will make in the U.S. this year. ♦