

REVENGE OF THE ELECTRIC CAR

A film by Chris Paine

By 2006, thousands of modern electric cars were destroyed by the same auto companies who built them. Now, only a few years later, the electric car is back from the dead, championed by a handful of people determined to remake the future.



FROM THE FILMMAKER



Chris Paine, Producer/Director

Last time, I made a film which told the story of the system within the automotive industry in the United States that was destroying innovation around bringing electric cars to the mass market because it threatened vested interests. This time our team tells a very different story: the tale of how four very different people challenged this system on their own terms (three from within and one from outside) to champion this innovation.

We decided to not make an “issue movie” because we had done that in the prior film. To consider this issue completely, we would have to make a miniseries rather than a 90-minute documentary. We were independently financed, and—given the critique of the first film—it took some time to get behind the corporate veil to tell an insider story. As you can imagine, we agreed to not share content with other players or with anyone for that matter. However, two companies featured in our story went public during our three years and one went bankrupt. That made our editing room into a very secure place.

We hope the movie inspires people to take chances on electric cars and overcome the disinformation and resistance to change that’s out there. For example, one of the biggest users of electricity in the world is the oil industry—simply to refine gasoline from crude oil. We could save so many resources by simply putting that electricity directly into

our cars and bypassing the middleman (gasoline refineries). Plug-in cars offer one of the best hopes of weaning us off of the incredible well-to-wheel costs of oil.

For me, ***Revenge of the Electric Car*** is a personal view of different kinds of entrepreneurship in America (corporate and individual) in terms of one of the very biggest industries in the world. Within that microcosm you can see how the system works and the often-overlooked role of individual leadership in all of its forms. The “Revenge” of the title was originally conceived given the bankruptcy of some of the car companies involved in the death of the electric car. Electric cars’ acceptance by so much of the mainstream auto industry after being scorned is the first step of their comeback. The next step will be consumer demand, pushed by early adopters and ultimately by the increasing costs and consequences of fossil fuels.

In terms of the electric car revolution, I hope ***Revenge of the Electric Car*** inspires people to test drive and buy this new generation of plug-in cars. Change is so difficult and it takes a lot of early adopters to make the leap. This is a leap I took 10 years ago and I consider myself very lucky. If the film inspires that, I’ll be happy.

– Chris Paine

THE FILM

The electric car is making a comeback, and *Revenge of the Electric Car* describes the conditions and the major players responsible for this development. The film takes a brief look back at the EV1, the limited-edition electric car General Motors (GM) produced in the late 1990s, which the company decided to discontinue, much to the dismay of EV1 drivers. Now, the business climate has changed, consumers are looking for more fuel-efficient cars, and technological developments have advanced to a point where large-scale production of electric cars makes economic sense. Focusing on three car companies and their leadership, the film paints an optimistic picture of the electric car's prospects in the U.S. auto market.

Zeroing in on GM's former vice chairman Bob Lutz, narrator Tim Robbins states that "sometimes change starts with the most unlikely people." A climate-change skeptic and former opponent of the electric car, Lutz is one of the people blamed for killing off the EV1. After seeing Toyota capture the technological and environmental high ground, Lutz tried in vain to convince GM to again produce an electric car. It wasn't until Tesla Motors, a Silicon Valley start-up, came out with an attractive, sporty electric car that General Motors got back into the game and began developing the Chevy Volt, a gas-electric hybrid. Lutz switched from being a serious opponent to being an enthusiastic electric vehicle (EV) advocate.

The man behind the company whose achievement spurred GM into action is Elon Musk. A young entrepreneur who made a fortune when he sold PayPal—his previous company—to eBay, Musk is considered a true believer who is willing to put his resources into developing an electric vehicle that is not harmful to the environment. However, the first car developed by Tesla has a major drawback: its price. At one hundred thousand dollars, the Tesla Roadster can appeal only to a high-end niche market.

The third individual profiled in the film is Carlos Ghosn, head of both Nissan and Renault. Ghosn is a capitalist, not a visionary. Having brought Nissan back from the brink of financial disaster, Ghosn is regarded as a formidable car mogul. He is deliberate and driven, and is following an aggressive strategy to address consumers' concerns by producing an affordable, mass-marketed electric car, the Nissan Leaf.

In addition to these three major figures in the car industry, the film presents a growing underground movement of individuals making their own electric cars. Greg Abbott (known familiarly as "Gadget") is representative of this movement. A do-it-yourselfer who converts cars from gas-powered to all-electric vehicles, he prides himself in being able to produce clean, quiet commuter cars for California drivers.

Between October 2007 and October 2009, all three companies move ahead with work on their respective vehicles. Then, in fall 2009 the economy collapses and half of the world's financial wealth disappears. General Motors is on the brink of bankruptcy, and the "Big Three" Detroit carmakers (GM, Ford, and Chrysler) send their chief executive officers (CEOs) to Washington, D.C. to ask for help. At Tesla's offices there are layoffs and huge financial problems. The



Revenge of the Electric Car

Tesla Delivery Center has a backlog of cars with problems needing to be fixed, delaying their delivery to customers who have made substantial down payments. And a bit of terrible luck befalls Gadget when his facility, along with all his cars and tools, is destroyed by an arson fire. Only Carlos Ghosn's company is untouched by calamitous events and he continues to display confidence in his plans to produce the Leaf.

As the year wears on, President Obama announces the government takeover of General Motors, whose CEO Rick Wagoner is fired; Bob Lutz is in exile at his home in Ann Arbor, Michigan; and Gadget is struggling with insurmountable toxic conditions at his new facility. Meanwhile, Tesla receives a \$90 million lifeline from Daimler and Nissan opens a plant in Smyrna, Tennessee. At the North American Auto Show, where all three carmakers have their products on display, Bob Lutz and Elon Musk run into each other and review some of the cars on the floor. Their subdued demeanors are in marked contrast to Carlos Ghosn's earlier enthusiastic presentation of the Leaf.

By 2010, things are looking up. Despite big losses on Wall Street, Tesla's initial public offering (IPO) raises \$226 million; GM's restructuring is working and the company is paying back its government loan; and Nissan receives a \$1.4 billion loan from the Department of Energy (DOE) to retrofit a plant for Leaf production. Tesla also receives a DOE loan for \$465 million and opens its new world headquarters in Palo Alto, California. And Gadget finds a new home where he resumes converting cars from gas to electric. It's now just a matter of time until the electric car gets its revenge and begins taking over America's highways.

SELECTED INDIVIDUALS FEATURED IN REVENGE OF THE ELECTRIC CAR

Dan Neil – Columnist, *The Wall Street Journal*

Danny DeVito – Actor, Former EV1 owner

Bob Lutz – Former Vice Chairman, General Motors

Elon Musk – Entrepreneur, Chairman and CEO, Tesla Motors

Carlos Ghosn – CEO, Nissan and Renault

Greg “Gadget” Abbott – Electric car converter

Martin Eberhard – Co-founder, Tesla Motors

Michelle Krebs – Auto analyst, Edmunds.com

Ray Wert – Editor, *Jalopnik*

Owen Thomas – *Valleywag*

Elizabeth Janczewski – Columnist, *The New York Times*

Bishop Charles H. Ellis III – Greater Grace Temple, Detroit

BACKGROUND INFORMATION

A Return to the Past

The first practical electric cars in the U.S. appeared in the early 1840s. Throughout the second half of the 19th century, various European inventors made improvements in the technology, and in the 1890s American interest in electric vehicles began to peak. In 1897 a fleet of taxis powered by electricity hit the streets of New York City, and by the turn of the century electric cars outsold both those powered by steam and by gasoline. Electric cars presented a driving ease not found in other types of cars. They did not require hand cranking to start nor shifting gears while in motion. They were quiet and free of gasoline odor. Electric cars were ideally suited to urban life at that time. The only good roads were in towns and cities, and with their limited range, electric cars were perfect for short, local trips.

Production of electric cars peaked in 1912 and continued into the 1920s. But by then, the U.S. had a better system of interurban roads requiring longer-range vehicles. The discovery of oil in Texas reduced the price of gasoline, and the invention of the electric starter eliminated the need for the hand crank. Finally, Henry Ford's development of the assembly-line process, which could efficiently mass-produce internal combustion engine vehicles, made gasoline-powered cars far more affordable than the less efficiently produced electric cars. By 1935, electric cars disappeared from U.S. roads, not to return for several decades.

Sources:

inventors.about.com/od/estartinventions/a/History-Of-Electric-Vehicles.htm

GM's EV1

1996 to 1999. With a design based on the Impact, GM's favorably received concept car, the EV1 was the first modern-day electric car to be mass-produced by a major automaker. The EV1 was available on a limited basis, in a few cities in California and Arizona, and it could only

be leased, not purchased. Although the car received highly favorable reviews from lessees, in February 2002 General Motors announced the cancellation of the program, removing all EV1s from the roads. Controversy surrounded that decision. GM claimed that there were service, parts and liability issues that came with too high a cost, and that it could not sell enough of the cars for the EV1 to be profitable. GM was accused of failing to support the electric car because it threatened the automaker's investment in producing gasoline-powered cars, and because electrical vehicle technology might cut into GM's profitable spare parts market, as electric cars have far fewer moving parts than combustion vehicles. Director Chris Paine's 2006 documentary, *Who Killed the Electric Car?* also suggests that the program was halted because it threatened the oil industry.

There is no question that the EV1 was enormously costly to develop, and battery technology at the time limited the vehicle's range and design. Many industry analysts believe, however, that by halting production of the EV1, GM missed a great opportunity to take the lead in the development of advanced auto technology, leaving the field open for others to jump ahead.

Sources:

www.greencar.com/articles/20-truths-gm-ev1-electric-car.php
www.businessweek.com/2000/00_33/b3694130.htm

BRIEF PROFILES

The Executives

Robert Lutz

Automotive career: Senior management and executive positions at BMW (3 years), Ford Motor Company (12 years), Chrysler (12 years), and General Motors (17 years: 1963–71 and 2001–10)

Notable achievements: His emphasis on design resulted in esthetic improvement in several of GM's models, winning them Car of the Year Awards; also spearheaded the development of the Chevrolet Volt

Current employment: Founder, Lutz Communications, a business consulting firm

Elon Musk

Automotive career: Chairman and CEO, Tesla Motors

Notable achievements: Began work as an entrepreneur, founding companies at age 24 (1995); co-founded X.com (1999), a financial services and email payments company which acquired PayPal, later sold to eBay; founded Space Exploration Technologies (Space X [2002]) to develop and manufacture space-launch vehicles; co-founded Tesla Motors (2003)

Current employment: Chairman and CEO of Tesla Motors; CEO and chief technology officer (CTO) of Space X; chairman of Solar City, a solar provider for homeowners, businesses, and government organizations



Carlos Ghosn

Automotive career: Michelin Tires (rose from plant manager to chief operating officer [COO], 18 years); executive vice president, Renault (1996); COO, Nissan (1999); CEO, Nissan (2001); CEO, Renault, (2005)

Notable achievements: Saved Nissan from near-bankruptcy, making the company profitable in one year; spearheaded the development of the Leaf, Nissan's all-electric car

Current employment: CEO of both Nissan and Renault

Sources:

www.boblutzsez.com/Robert_Lutz_Ann_Arbor_MI.html

www.crunchbase.com/person/elon-musk

edition.cnn.com/2008/BUSINESS/06/11/ghosn.profile/#cnnSTCText

THE CARS**Chevy Volt**

Type: Plug-in hybrid

Range: 375 miles

Seating capacity: 4

Fuel economy rating: 93 MPG-e*

Tesla (Roadster and Model S)

Type: All-electric

Range: 245 miles (Roadster); 300 miles (Model S)

Seating capacity: 2 (Roadster); 4 (Model S)

Fuel economy rating: MPG-e* not available (Comparing average gas prices and electricity prices, the Roadster could go 150 miles for the price of one gallon of gas.)

Nissan Leaf

Type: All-electric

Range: 100 miles

Seating capacity: 5

Fuel economy rating: 99 MPG-e*

*Miles per gallon gasoline equivalent (MPG-e) is a measure of the average distance traveled per unit of energy consumed. The U.S. Environmental Protection Agency (EPA) uses MPG-e to compare the energy consumption of alternative fuel vehicles, electric vehicles, and other advanced technology vehicles with the fuel economy of conventional internal combustion vehicles, expressed as miles per gallon.

Sources:

www.chevrolet.com/volt-electric-car

www.teslamotors.com/goelectric

www.nissanusa.com/leaf-electric-car

THE COMPANIES**General Motors**

Founded in 1908 by William Durant, a leading manufacturer of horse-drawn vehicles, in Flint, Michigan, the company's initial holding was the Buick Motor Company. Later acquisitions were Chevrolet, Oldsmobile, Cadillac, and Pontiac.

Achievements and innovations: During World War II, one hundred percent of GM's production was in support of the Allied war effort, with GM delivering more than \$12 billion worth of airplanes, trucks, and tanks. GM pioneered the use of engines that could run on unleaded gasoline (1971), and introduced the catalytic converter to reduce emissions (1974), a technology still in use by the entire auto industry.

Additional facts: Several decades of competition from foreign imports, high gas prices, and inefficient management led to serious financial problems. GM declared bankruptcy in 2009, resulting in a government takeover and restructuring. GM is now a leaner company with four brands in the U.S.: Chevrolet, Buick, Cadillac, and GMC. More than 70 percent of its sales come from outside the U.S.

Tesla

Tesla's founders are entrepreneurs and businessmen who had no connection to the traditional American auto industry. Initially, there were two independent teams who sought to commercialize the T-Zero electric sports car. The two teams agreed to join forces, with Martin Eberhard becoming CEO and J. B. Straubel becoming chief technical officer (CTO). Elon Musk became chairman and overall head of product design. In addition, he provided half of the initial \$60 million in investment funds. Other founders were Marc Tarpenning, a business partner of Eberhard's, and Ian Wright. Tesla Motors was launched in 2003.

Tesla's first car was the high-end Roadster, produced in limited quantities. The company's next available vehicle was the more moderately priced Model S sedan. Tesla also sells electric powertrain systems to Daimler and Toyota.

Achievements and innovations: The Roadster is the first mass-produced automobile to use lithium-ion battery cells, and the first EV with a range greater than two hundred miles per charge.

Additional facts: Tesla will remain a Silicon Valley company, with its headquarters in Palo Alto, California, and its main production facility in Fremont, California.

Nissan

Nissan originated as a holding company founded by Yoshisuke Aikawa in 1928, controlling foundries and auto parts businesses. In the early 1930s, Aikawa gained control of DAT Motors (manufacturer of the Datsun) and also started the Nissan Motor Company. Over the next several decades, Aikawa worked with American and European designers and car manufacturers to acquire the latest auto-making technology. Beginning in the 1950s, Nissan expanded into worldwide markets, building plants in Europe, the U.S., Brazil, South Africa, and throughout Asia.

Achievements and innovations: After facing severe financial difficulties, Nissan experienced what many industry analysts consider to be one of the most spectacular corporate turnarounds in history, with record profits within three years of implementing changes and a revitalization of several of its major brands.

Additional facts: Two of Nissan's well-known brands are Datsun, which Nissan sold in most export markets until 1982, and Infiniti, the luxury brand Nissan sells in North America.

CARS AND THE ENVIRONMENT

A few statistics point to the tremendous health and environmental effects of the automobile:

- Carbon dioxide (a greenhouse gas that traps solar radiation in the atmosphere) and carbon monoxide (a poisonous gas that prevents blood from carrying oxygen to vital organs of the body) are the primary air pollutants produced by cars.
- Cars release approximately 333 million tons of carbon dioxide—20 percent of the world's total—into the atmosphere annually.
- Cars are primarily responsible for ozone pollution; 72 percent of nitrogen oxides and 52 percent of hydrocarbons, both of which are components of smog, are released by cars.
- Sport Utility Vehicles (SUVs) release up to 47 percent more pollution than the average-sized car.
- The American Lung Association reports that thirty thousand people are killed by car emissions annually in the United States alone. Air pollution also causes numerous respiratory and cardiovascular problems and may exacerbate preexisting conditions such as asthma.
- There are 752 cars for every one thousand people in the United States.
- In China, the number of cars that are driven has doubled every 5 years for the last 30 years.
- Hybrid and electric cars have less of an environmental impact, but hybrids use gasoline as one power source, creating polluting emissions, and plug-ins depend on electricity, which isn't always cleaner than gasoline.

Sources:

www.thegoodairlady.com/car_pollution_statistics_000249.html
www.geshho.com/blogs/news/3266222-facts-of-car-pollution
science.howstuffworks.com/science-vs-myth/everyday-myths/does-hybrid-car-production-waste-offset-hybrid-benefits2.htm

TOPICS AND ISSUES RELEVANT TO REVENGE OF THE ELECTRIC CAR

A screening of *Revenge of the Electric Car* can be used to spark interest in any of the following topics and inspire both individual and community action. In planning a screening, consider finding speakers, panelists, or discussion leaders who have expertise in one or more of the following areas:

Electric car technology
 History of the U.S. automobile industry
 U.S. industrial policy
 Environmental impact of automobiles
 Relationship between the oil and auto industries
 Economics of the auto industry
 Auto design and engineering
 Government regulation of the auto industry
 Pollution standards for cars
 Green technology

THINKING MORE DEEPLY

1. Do you think the electric car will catch on and win over consumers? What specific factors would make buying an electric car an attractive proposition for most people?
2. Do you agree with Thomas Friedman's statement that electric car development is not going to be solved by regulators or bureaucrats, but by engineers, innovators, and entrepreneurs? Is there a role for government in this process? If so, what is it?
3. Was the government bailout and takeover of Detroit automakers in 2009 a good idea, or was it just preserving an industry that needs to make fundamental, structural changes? Can a new type of car industry emerge in Detroit? If so, what will it take in order for that to happen?
4. Some people feel that GM is too damaged as a company and can't be relied on to produce and sell an electric car that consumers want. Do you agree? Why or why not? What is the public perception of the traditional U.S. auto industry?
5. Why do you think Carlos Ghosn declined when he was asked to run General Motors?
6. Can Tesla remain a viable company without following the Detroit model, that is, mass-producing affordable cars for the general public?
7. Of the three CEOs profiled in the film, which one do you think has the most successful strategy for his company's success in producing an electric car? Explain your choice.

8. Do-it-yourselfers such as Greg Abbott (Gadget) are essentially creating custom-made electric versions of brand-name cars. How much of an impact do you think they will have on the market for electric cars? What advantages and disadvantages do you see in acquiring a car that's been converted from gas to electric?
9. Has this film changed your thinking about electric cars? If so, in what way?

SUGGESTIONS FOR ACTION

Together with other audience members, brainstorm actions that you might take as an individual and that people might do as a group. Here are some ideas to get you started:

1. Analyze how cars are advertised, especially on TV. Do the ads give you sufficient information to make a wise purchasing decision? What information would help you in buying a new car today?
2. Imagine replacing your current gasoline-powered car with an electric car. What trade-offs would you be willing to make in order to be more "green"? Remember to consider the source of electric power in your area.
3. If you are planning to purchase a new car, use the EPA's Green Vehicle Guide (www.epa.gov/greenvehicles/Index.do) to help you choose the cleanest, most fuel-efficient vehicle that meets your needs.
4. Are you mechanically inclined? If so, and you're familiar with the current systems of your car or truck, then you might consider converting your gas-powered vehicle to an electric one. Find information on how to do it at www.electric-car-conversion-kits.com; a review of various electric car conversion guides can be found at www.electricity4cars.com.
5. If you would like to promote electric vehicle technology, Plug In America offers numerous suggestions on how you can help. Visit the "Take Action" section of their website at www.pluginamerica.org/take-action.
6. Regardless of what kind of vehicle you drive, you can help to reduce the overall number of vehicles on the roads. Find out about the commuting alternatives that exist in your community and consider using public transportation or joining a car pool, or if your workplace allows the flexibility, telecommuting several times a week.

For additional outreach ideas, visit www.itvs.org, the website of the Independent Television Service (ITVS). For local information, check the website of your PBS station.

RESOURCES

www.revengeoftheelectriccar.com/film.html

This is the official website of the film *Revenge of the Electric Car* and

contains a section on electric vehicle do-it-yourselfers.

www.imdb.com/title/tt0489037/synopsis

This site contains a synopsis of director Chris Paine's earlier film *Who Killed the Electric Car?*

History and Technology of the Electric Car

auto.howstuffworks.com/fuel-efficiency/hybrid-technology/history-of-electric-cars.htm

This site provides detailed information on the electric car's history.

www.time.com/time/business/article/0,8599,1871282,00.html

This site contains a brief history of the electric car.

www.howstuffworks.com/electric-car.htm

This site explains how electric cars work.

www.hybridcars.com/electric-car

This website explains some of the inner workings of electric cars and lists a wide range of both upcoming and discontinued electric cars.

Electric Car Organizations

www.electrictauto.org

The Electric Auto Association is a nonprofit educational organization – with chapters nationwide – that promotes the advancement and widespread adoption of electric vehicles.

www.pluginamerica.org

Plug In America is a California-based coalition of RAV4-EV drivers; former lessees of Honda EV+, GM EV1, Ford Ranger, and Ford Th!nk City electric cars; advocates of energy independence and clean air.

Government web Websites

www.nhtsa.gov/fuel-economy

This section of the National Highway Traffic Safety Administration's website contains information on fuel economy standards and greenhouse gas emissions.

www.epa.gov

The U.S. Environmental Protection Agency provides a wide range of information on electric vehicles and their environmental benefits. Type in "electric vehicles" in the "Search" box.

www.dot.gov

The U.S. Department of Transportation lists numerous articles about electric and other alternative automobile technologies. Do a "Quick Search" for "electric vehicles."

Additional Information on Featured Auto Executives

www.businessweek.com/autos/autobeat/archives/2010/03/bob_lutz_retires_from_gm_long_live_his_influence.html

This article describes Bob Lutz's wide-ranging influence on General Motors.

en.wikipedia.org/wiki/Elon_Musk

This site includes information on Elon Musk's personal life as well as the controversy surrounding the founding of Tesla Motors.

en.wikipedia.org/wiki/Carlos_Ghosn

This site provides Carlos Ghosn's personal background and information on the accolades he has received in Japan.