

**Electric Vehicles:  
History and Efficiency**

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Due to the poor economic and environmental record of the US, interest in electric vehicles is beginning to increase. The advantages of electric vehicles include the following: (1) Electric vehicles (EVs) do not require gasoline or oil. As a result, significant cost savings can be realized over time. (2) Electric vehicles produce zero emissions and are more environmentally friendly than gas-powered vehicles. Current disadvantages of EVs include (1) Initial cost of EVs is generally higher than for gasoline-powered vehicles. Battery cost is a major contributor to the high price of EVs. (2) Range (distance traveled between battery charges) is limited by battery performance. Most vehicles used now are powered by gasoline derived from costly foreign oil. Electric vehicles are completely oil-free and zero-emissions vehicles; therefore, they can help save the environment and save money. Some vehicles, such as the Tesla Roadster, can get up to 250 miles on a single charge ("Charging," n.d.). Although electric vehicles (EVs) are a clear alternative to fossil-fuel-powered vehicles, they are mass-produced by few companies and sold at very high prices.

The electric motor was invented long before the internal combustion engine. Electric vehicles were first used in the mid 1800s and were manufactured in volume in the late 1800s and early 1900s. Alessandro Volta invented the first electric battery in 1800, and Joseph Henry invented the first primitive direct current (DC) motor in 1830. Battery-powered electric technology was applied to the first land vehicle by Thomas Davenport in 1834. Early electric vehicles were very successful in urban areas, due to paved roads, available power, short driving distances, and low speed limits (Leitman & Brant, 2009, p. 35).

Oil was discovered in Western Pennsylvania by Edwin Drake in 1859. This was the spark that ignited the oil revolution. Oil quickly became vitally important to the United States economy. During the 1960s, electric vehicle development languished, but commercial and industrial EV activities continued to flourish. However, most of the US population still owned gasoline-powered vehicles. After the poor environmental record of the US during the 1960s, US citizens began to consider with the environmentally friendly choices: either convert their gasoline vehicles into EVs or purchase an electric vehicle (Leitman & Brant, 2009, p. 44).

In October 1973, an event called “the first oil shock” occurred. The Arabs cut down their oil production by five percent each month in order to meet their price objectives. Oil companies had to scramble in order to buy as much oil as they could, and consumers did the same. This event caused gas prices to double, and interest in EV began to rise once again. In the 1980s, EV development began to slow once again due to the “oil shock glut” of 1986. Gas prices dropped dramatically, and EVs seemed to simply disappear (Leitman & Brant, 2009, p. 47).

In the 1990s, there was substantial electric vehicle technology improvement. EVs had achieved higher range, higher top speed, and increased dependability. During the 1990s, California passed laws (Zero Emissions Vehicles [ZEV] mandate) requiring auto makers to produce zero-emissions vehicles. However, these laws were challenged in legal proceedings against California. Eventually, the law was changed, effectively releasing auto makers from having to build EVs at all. As a result, auto makers terminated their programs and began to recall and destroy the EVs they had produced. Roughly 1000 of these vehicles remained in private hands, due to public pressure. This event caused a former EV driver and activist Chris

Paine to create a full-length documentary, entitled “Who Killed the Electric Car?,” which premiered at the 2006 Sundance Film Festival and was released in theaters by Sony Pictures Classics (2006).

Understandably, the attack on the World Trade Center, the Pentagon, and United Airlines flight 93 on September 11, 2001, clearly show our reliance on imported oil is damaging our national financial security. There is a need for mass production of EVs and a decrease of imported oil. GM invented an EV known as the Volt, which is planned to become a plug-in hybrid. Tesla Motors invented its Tesla Roadster on July 20, 2006. The Tesla Roadster has an amazing AC drive of a new design, a new controller, new battery, and new battery subsystem. The Tesla Roadster is six times as efficient as the best sports cars. The Tesla Roadster has a range of 200 miles and a top speed of 125 mph. The Tesla cost ranges from \$30,000-\$60,000, depending on the model that is purchased. Tesla is a relatively new company but does have several dealerships across the nation (Leitman & Brant, 2009, pp. 66-67).

Vehicles with internal combustion engines are complicated and require a large, heavy vessel to withstand high temperature and high pressure combustion processes. Internal combustion engines require a cooling system, exhaust system, ignition system, fueling system, lubricating system, and a starting system. It is difficult to keep all of these systems working correctly, which means more frequent repairs and higher repair costs. Internal combustion engines create waste, heat, and pollution. The input fluids and exhaust gases are toxic. Internal combustion engines are also only 20 percent efficient (*Electric vehicle conversion*, 2005).

EVs require no fuel of any kind and are completely electric. As a result, they are much less expensive to operate than internal combustion engines. However, the cost for batteries is not cheap, and the batteries must be replaced every five to six years. EVs are less complex than gasoline-powered vehicles, consisting mainly of an electric motor, motor controller, and a single or set of batteries, depending on if the batteries are lead-acid or lithium-ion. Electric motors have only one moving part, while internal combustion engines have hundreds. As a result, electric motors have high reliability and low maintenance costs. In the past, EVs have had low top speed and low range. With Tesla and GM leading the way, however, new technology is being developed to give EVs higher top speeds and range (130 mph and 300 miles). Tesla and GM are not only optimizing the EV, but they are also causing the US to gain interest in converting vehicles to electric power (Advanced DC, 1992).

EVs are zero-emissions vehicles (ZEVs). Therefore, they do not put off any toxic solids or exhaust gases. Substitution of EVs for gasoline-powered vehicles will reduce carbon dioxide, hydrocarbon, and nitrogen oxide emissions. Even the power plants that create energy for the EVs are held to a higher standard than those of the internal combustion engines. The only possible wasted elements of EVs are the batteries, which are recyclable. An EV converts about 70 percent of the charging energy into motor energy, whereas a typical gasoline-powered vehicle converts only about 20 percent of the energy in gasoline into engine energy. The United States consumes 20.8 million barrels of petroleum a day, of which nine million barrels is gas. There is a limited amount of oil, and as the supply continues to decrease, gas prices will continue to increase (Leitman & Brant, 2009, p. 55).

The US is gaining interest in converting from gas-powered vehicle to electric. The process of converting a gas-powered vehicle to electric power is much less expensive than buying a new hybrid or electric vehicle. It is also not as complicated as it may sound. Bob Batson says, "Building an EV takes time and money. It requires 100-200 hours of labor and \$5000-\$9000 in components" (Batson, 2002, p. 27). This is much less expensive than buying a new electric vehicle, which could cost anywhere from \$30,000-\$60,000. In near 200 hours of labor, a conversion can be completed. The converted electric vehicle can be very practical for everyday use (Batson, 2002, p. 27).

Slowly, auto makers are producing more EVs and hybrids, but most US citizens still own gasoline-powered vehicles. It will most likely be several years before EVs become dominant. Due to the high costs of foreign oil and the inefficiency of the internal combustion engine, the United States economy is suffering. It is time for a change in this nation. Despite the high price to purchase an EV, much of the cost will be offset, since it does not require gasoline. Another alternative to purchasing an EV is to convert a gasoline-powered vehicle to electric power. This alternative is much less expensive, but the downfall is that the range of the converted vehicle will not be as high as that of a purchased EV. It is too costly to continue purchasing foreign oil and to continue harming the environment because of pollution produced by foreign oil. As the EV continues to catch on with the major auto makers, the cost to purchase an EV will decrease. Electric vehicles are the one of the answers to the economic and environmental problems of the United States.

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