

An Abbreviated History of the Electric Vehicle

For the EVCO EV Course 2009

Darryl McMahon

The golden period of the electric vehicle was from 1895 to roughly 1904. During this period there were literally hundreds of electric car and truck manufacturers in North America and Europe. Development of EVs in England was stunted by the Red Flag Laws. Thousands of electric cars were produced.

Those that wish to develop electric vehicles today can learn much from what has worked and what has not over the past 175 years, paying particular attention to why things did and did not work on the grand scale.

In particular, other than electronics, little technological progress has actually been made in the past century. By 1909, electric cars were running on lead-acid batteries, had exceeded 100 miles per hour, and achieved ranges of 180 miles and more per charge. Battery swapping had been implemented on an industrial scale. Hub motors were used in production vehicles. Charging stations for industrial vehicles had been developed in major centres.

Even those planning a one-off conversion or ground-up can learn from the thousands of vehicle conversions that have been done in the past. The experience of others is instructive as to good donor vehicles, components, techniques, issues and solutions.

The electric vehicle is not a simple piece of technology to be examined in isolation from its environment. It is a creature of man, and must be understood within the context of society, culture, economics and contemporary philosophy.

The electric vehicle has not failed because we were waiting on technology, since electric vehicles and those working on them have been technology leaders and innovators.

Internal combustion engine vehicles have dominated where their disadvantages and costs are spread out over the environment and society, and not borne fully by the user. In enclosed environments, where emissions are a direct and immediate problem, electric drive has been the key drive technology (mines, long railway tunnels, materials handling). Where electric performance advantages have been valued, and autonomy is not an issue, electric drive has been a strong contender (trolley systems, streetcars, subways, high density rail corridors). Where torque or quiet operation have been key advantages, but grid connection is not feasible, hybrids have filled the gap (large ships with pod drives, submarines, heavy haulers, locomotives).

Ottawa had an electric streetcar system from 1891 to 1959 – powered completely by hydroelectricity. The Hull-Aylmer electric railway was powered by a hydro plant at Lac Deschenes. The first private automobile operated in Ottawa was a battery electric car. It arrived in 1899 and it was the property of Thomas Ahearn.

By 1900, there were more than 100 electric cabs operating in New York City. Some other large cities had similar operations, though generally on a smaller scale.

Electric cars were the choice of high society and doctors, because they were simple to operate, clean, quiet and reliable. No hand-crank, started every time. Electric cars were the range champions, over horses, gasoline cars and steamers – all of which relied on the existing horse watering trough infrastructure of the time.

The electrical infrastructure in the early 1900s was minimal. Some areas had DC, others AC. No standard voltage or frequency. Residential electricity was rare. Primary markets were municipal lighting and transit systems. Near universal access to electricity in urban North America doesn't take place until the 1950s.

The electrics of the late 60s and 70s were a fast response to the air quality issues and OPEC embargoes. They were small, cheap, and employed primitive technology. They were the hairshirts of the automotive industry. They utilized under-rated components and parts, and general reliability was an issue. Fit and finish were poor. They were aimed at the commuter market, and intended to compete on price, and hoped that environmental benefits would help gloss over their deficiencies. Most were designed to travel at 40 mph or less – essentially creating a City Car vehicle class that has never been officially sanctioned in North America.

Hobbyists in the 60s and 70s tended to use military surplus aircraft starter generators for car motors, and golf cart technology for controllers and batteries. Chargers were eclectic and temperamental.

The electrics of the 1990s were different. They embraced leading edge electronics technology, advanced batteries and were designed to be fully functional, highway-capable cars. They intended to displace the internal combustion engine vehicle, not complement it in the urban mission only role. We continue to wait for an affordable super battery, but most of us still use lead-acid batteries for vehicles that fill the urban commute and errands role.

Our biggest barriers today are mythology, the inertia of the major automakers and an intransigent regulatory regime in many jurisdictions.

Some dates of interest.

1837 – First electric vehicle

1843 – First hydrogen fuel cell

1859 – First rechargeable battery

1861 – Otto cycle engine

1881 – First rechargeable electric car

1887 – Tesla patents AC induction motor

1892 – Diesel engine

1899 – B.G.S. Electric car travels 180 miles on a charge (lead-acid batteries)

1899 – World Land Speed Record – 66 mph – La Jamais Contente

1900 – Selden patent upheld in court

1901 – World Land Speed Record – 104 mph – Baker Torpedo

1905 – 86% of car sales are gasoline; 7% each for electric and steam

1908 – Ford Model T starts production – no electric starter – doesn't pay Selden royalty

1911 – Kettering invents the electric starter
 1912 – Cadillac has the first electric starter
 1912 – GMC starts electric truck production – builds over 800 by 1917
 1914 – Galt electric hybrid – features steering headlight
 1914 – Over half the cars registered in the U.S. are Model Ts
 1914 – World War 1 begins
 1916 – Baker and Woods both introduce hybrids – sales are poor due to cost premium
 1930s – Rural electrification programs bring standardization and near universal access to electricity
 1960s – Smog in Southern California and nascent environmentalism
 1964 – GM Electrovair prototype
 1966 – GM Electrovair II prototype
 1966 – GM Electrovan hydrogen fuel cell vehicle
 1968 – CalTech – MIT Clean Air Race
 1971 – First lunar rover on the moon
 1973 – First OPEC embargo
 1974 – Sebring Vanguard CitiCar
 1975 – Zagato Elcar (ZeLe)
 1976 – U.S. Electric and Hybrid Vehicle Act enacted
 1978 – Second OPEC embargo
 1979 – GM Electrovette prototype
 1979 – Marathon C-300 (Montreal)
 1980s – Reaganomics, world recession, oil glut, end of the EV renaissance
 1990 – GM introduces Impact
 1990 – CARB introduces first low emissions mandate
 1993 – Clinton administration creates Partnership for a New Generation Vehicle (PNGV) program
 1996 – CARB modifies the mandate, removing 1998 target
 1997 – Bombardier NEV – built in Montreal, never sold in Canada
 1998 – U.S. government creates NEV vehicle class
 2000 – Bush administration kills PNGV (multiple 90 mpg diesel hybrid sedans developed)
 2000 – Canada adopts U.S. NEV rules – electric only
 2001 – Prius and Insight arrive in North America
 2003 – CARB guts the ZEV mandate
 2003 – Automakers start retrieving and crushing their CARB vehicles
 2006 – Ontario permits e-bikes under pilot project
 2008 – Quebec starts pilot project for 2 LSVs manufactured in Quebec
 2009 – Ontario legalizes a unique variant on the LSV – nobody wants to play
 2009 – Ontario legalizes electric bikes on a permanent basis
 2009 – Ontario announces incentives for BEVs and PHEVs to begin in 2010

References:

"Taking Charge - The Electric Automobile in America" by Michael Brian Schiffer (1994 -ISBN 1-56098-355-8). If you are only going to read one book about the history of electric vehicles, I would like it to be this one. This book focuses on the historical context (technological, infrastructure, social and business), that explains why the electric vehicle failed to keep pace with the gasoline engine. There is no single, simple reason, but it was not because the electric vehicle had an inferior technology or because of the electric starter.

"The Complete Book of Electric Vehicles" by Sheldon R. Shacket (1981 - ISBN 0-89196-086-4). This book provides a very sketchy history of electric vehicles prior to the 1970's, but a fairly comprehensive review of the electric vehicles of the 1970's, particularly in North America, devoting 95 of the 224 pages of the book to this topic. Unfortunately, this leaves the book feeling rather dated some 16 years later. Still, there is also good coverage of basic fundamentals, and on the whole, it is still worth reading.

"History of the Electric Automobile: Battery-Only Powered Cars" by Ernest H. Wakefield, PhD., (1994 - ISBN 1-56091-299-5; also SAE R-122). This is a very scholarly and complete volume on the subject. Expensive, and possibly hard to find, but a must for the serious student of EV history around the planet.

"History of the Electric Automobile: Hybrid Electric Vehicles" by Ernest H. Wakefield, PhD, (1998 - ISBN 0-7680-0125-0, also SAE R-187). Expensive and very hard to find. Much lighter than the previous volume, and a considerable amount of the book is devoted to the topic of solar-electric cars.

"The Lost Cord" by Barbara E. Taylor (1995 - ISBN 1-57074-295-2). This book has some general history on EVs, primarily in North America, but the focus is on the story of Bob Beaumont and the CitiCar.

"The Car That Could" by Michael Shnayerson (1996 - ISBN 0-679-42105-X). This is an inside view of the development of the GM EV-1, which ends as the car is being prepared for production and lease to end-users. Strong focus on the people and events that shaped the environment for the development of the EV-1.

"Electric Vehicles" by Nick Georgano (also known as G.N. Georgano - G.N. for George Nicolas) (1996 - ISBN 0-7478-0316-1). This book is a disappointment for the price (about US\$40 for just 32 pages - more than a dollar per page) and coming from the author of "The New Complete Encyclopedia of Motorcars, 1885-Present" published in 1982. Focus is on British and European vehicles, almost a pamphlet for the Beaulieu collection.

"World Guide to Battery-Powered Road Transportation" published by McGraw-Hill (1980 - ISBN 0-07-010790-4). A good snapshot of the electric vehicles available internationally in the late 1970's, primarily in response to the first OPEC oil shock.

"The Electric Vehicle: Technology and Expectations in the Automobile Age " by Gijs Mom, (2004 – Johns Hopkins University Press, ISBN 0801871387)

<http://www.evalbum.com>

Large listing of conversions and electric vehicles on the Web.

<http://www.econogics.com/ev/evhistory.htm>

Extensive information about the history of electric vehicles prior to the 1990s. Also hosts the EAA history pages, and provides links to other on-line EV history sites.