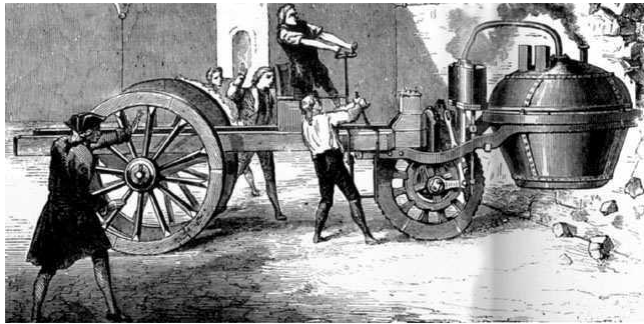


HISTORY OF EV AND HEV



History – Electric car



Cugnot's fardier

- In 1769, Frenchman Nicolas Cugnot built a **steam-powered motor carriage** capable of six miles per hour.
- In 1825, British inventor Goldsworthy Gurney built a steam car that successfully completed a 85 mile round-trip journey in ten hours time.



- Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland built the **first crude electric carriage**.
- A small-scale electric car was designed by Professor Stratingh of Groningen, Holland, and built by his assistant Christopher Becker in 1835.

History – Electric car



The first practical electric car may have been built by the English inventor Thomas Parker in 1884.

- Practical and more successful electric road vehicles were invented by both American Thomas Davenport and Scotsman Robert Davidson around 1842. Both inventors were using **non-rechargeable electric cells**.
- 1870 : Sir David Salomon developed a car with a light electric motor and **very heavy storage batteries**. **Driving speed and range were poor.**

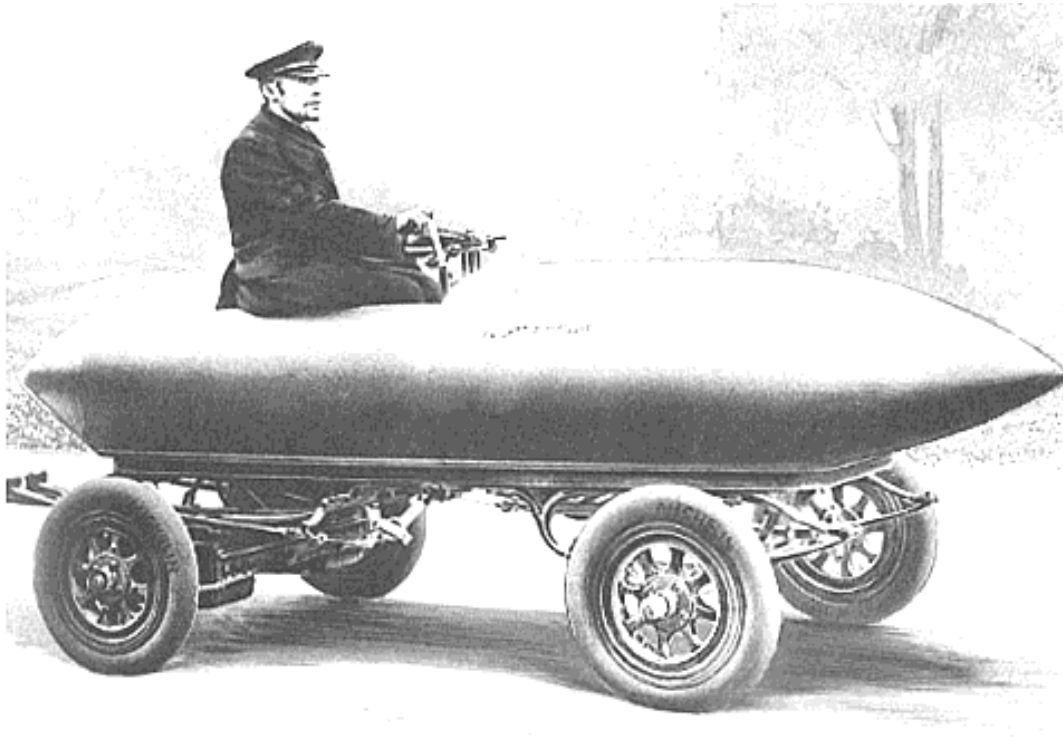
History – Electric car

- Frenchmen Gaston Plante invented a better storage battery in 1865 and his fellow countrymen Camille Faure improved the storage battery in 1881. This improved-capacity storage battery paved the way for electric vehicles to flourish.
- 1890 – 1910 – Period of significant improvements in battery technology, specifically with development of the modern lead-acid battery by H. Tudor and nickel-iron battery by Edison and Junger.
- Electric vehicles would hold all vehicle land speed records until about 1900.



Bailey electric car
powered by Edison's
NiZn batteries

History



- 1899: The first car to break the 100 km/h (105,88 km/h) is an electric car: The «*Jamais contente*» was driven by its Belgian inventor [Camille Jenatzy](#). The car is made of partinium (an laminated aluminum alloy) while its aerodynamics is inspired by torpedoes

History



- 1900: The German **Ferdinand Porsche**, at age 23, built his first car, the Lohner Electric Chaise. It was the world's first front-wheel-drive.

In 1900 for Paris International exhibition, Ferdinand Porsche designed and built the **Elektromobil Lohner-Porsche**, a vehicle equipped with **4 motors inserted in the wheel hubs** in order to save room.

Porsche's second car was a hybrid, using an internal combustion engine to spin a generator that provided power to electric motors located in the wheel hubs. On battery alone, the car could travel nearly 40 miles.

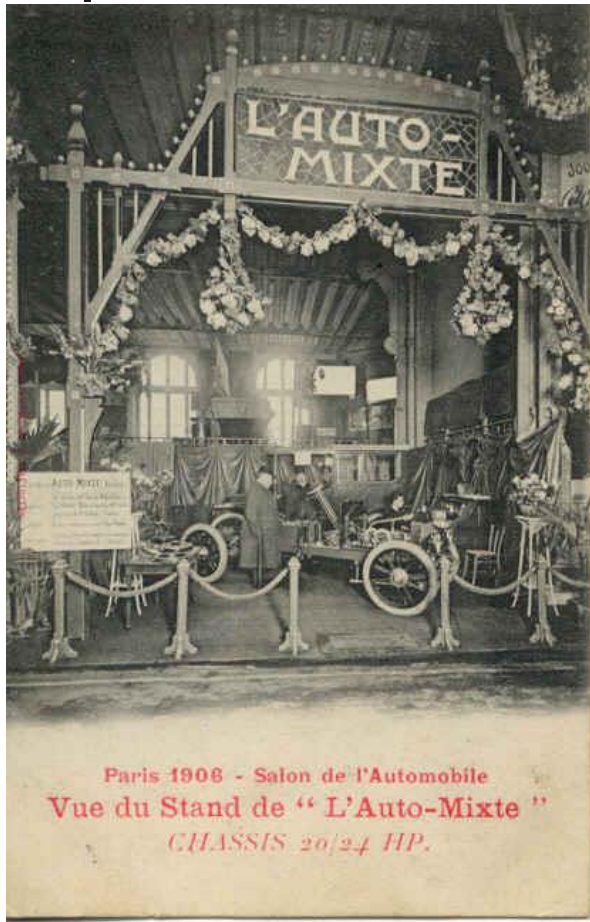
History



This car, made in 1903 by the Krieger company, used a gasoline engine to supplement a battery pack

- 1899: The Pope Manufacturing Company merged with two smaller electric car companies to form the Electric Vehicle Company, the first large-scale operation in the American automobile industry.
- 1900: American car companies made 1,681 steam, 1,575 electric and 936 gasoline cars. In a poll conducted at the first National Automobile Show in New York City, patrons favored electric as their first choice, followed closely by steam.

History



- 1899: *Henri Pieper*, an engineer and car manufacturer from Liege introduces a 3-1/2 horsepower "voiturette" in which the *small gasoline engine was mated to an electric motor under the seat*.
- When the car was "cruising," its electric motor was acting as a *generator, recharging the batteries*. But when the car was climbing a grade, the electric motor, mounted coaxially with the gas engine, gave it a boost.
- Pieper's idea to use electric motor to assist the internal combustion engine allows the vehicle to reach a 25 mph velocity.

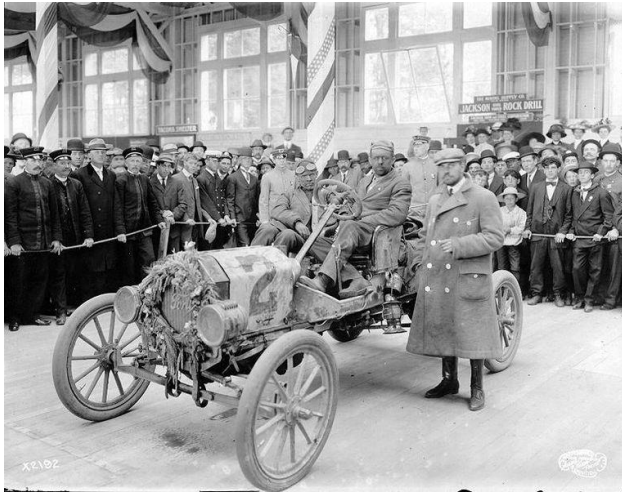
History

- As soon as 1905-1906 Henri Pieper creates the **petroleo electrical cars**, combining a thermal engine with a electric motor. The **hybrid vehicle** was born
- The Pieper patents were exploited by the Belgium company **Auto-Mixte** (located in Nessonvaux, near Liege), to build commercial vehicles from 1906 to 1912.



Pieper hybrid truck for Antwerp firemen (1912)

History



Ford T no 2 on display
in Seattle

- 1904: Henry Ford overcame the challenges posed by gasoline-powered cars — noise, vibration, and odor — and began assembly-line production of low-price, lightweight, gas-powered vehicles. Within a few years, the Electric Vehicle Company will be failed.
- 1910: A car maker builds an hybrid truck that uses a 4 cylinder engine spinning a generator, which eliminates the need for a transmission and a battery pack. These trucks are sold up to 1918.
- 1913: With continuous improvement of ICE like the self-starter (making easier for all drivers to start gas engines), steamers and electrics were almost completely wiped out.

History

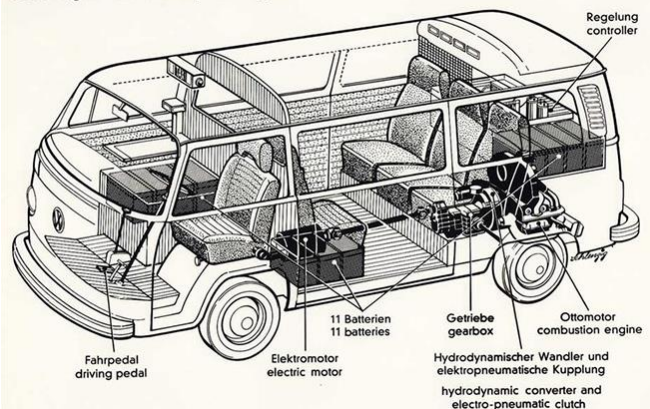


This 1921 Owen Magnetic Model 60 Touring uses a gasoline engine to run a generator that supplies electric power to motors mounted in each of the rear wheels.

- 1913. In this year, sales of electric cars dropped to 6,000 vehicles, while the Ford Model T sold 182,809 gasoline cars.
- 1920-1965: **Dormant period for mass-produced electric and hybrid cars.** So-called alternative cars became the province of backyard tinkerers and small-time entrepreneurs.
- 1966: U.S. Congress introduced first bills recommending use of electric vehicles as a means of reducing air pollution.
- 1973: The Arab oil embargo brings increased gasoline prices and a new interest in electric and hybrid vehicles

History

Volkswagen Taxi with Hybrid Engine



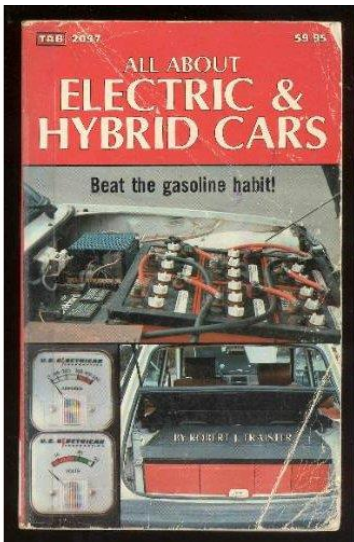
- 1970-1980: "VW Taxi" produced by Volkswagen in Wolfsburg, West Germany. The Taxi, which used a **parallel hybrid configuration** allowing flexible switching between the gasoline engine and electric motor, logged over 8,000 miles on the road, and was shown at auto shows throughout Europe and the United States.
- 1975: **AM General**, a division of American Motors, began delivery of 352 **electric vans to the U.S. Postal Service for testing**.
- 1975: Government program to **advanced electric and hybrid technology** is implemented by the U.S. Energy Research and Development Administration.



History

- 1976: U.S. Congress enacted Public Law 94-413, the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976. Among the law's objectives were to work with industry to improve batteries, motors, controllers, and other hybrid-electric components.
- 1976: General Electric was chosen to construct a parallel-hybrid sedan, and Toyota built its first hybrid — a small sports car with a gas-turbine generator supplying current to an electric motor.
- 1977-1979: General Motors spent over \$20 million in electric car development and research, reporting that electric vehicles could be in production by the mid-1980s.

History

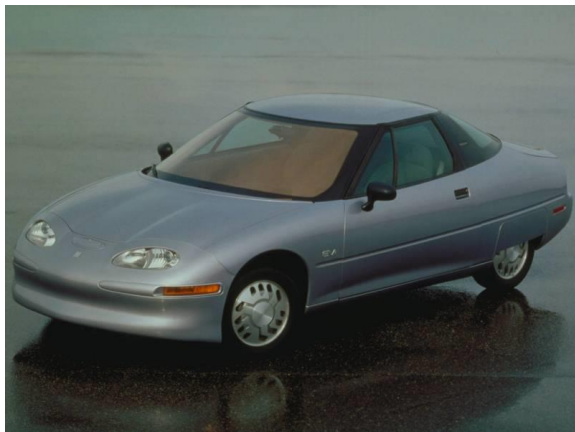


- 1982: « **All about Electric & Hybrid Cars** » by Robert J. Taister. The author emphasizes the **battery problem** which should be circumvented by using a generator onboard and should charge the batteries while driving downhill for instance.
- 1991: **United States Advanced Battery Consortium** (USABC) launches a program to make a "**super**" **battery** in hopes of getting electric cars on the road as soon as possible. The USABC invests over \$90 million in the nickel hydride battery which can "accept three times as many charge cycles as lead-acid" and also works well in the cold weather.
- 1992: **Toyota Motor Company** releases a document that outlines goals to develop and market vehicles with the lowest emissions possible. It is called the "**Earth Charter.**"

History



Toyota Prius I



GM EV1

- 1997: **The Toyota Prius** was introduced to the Japanese market, two years before its original launch date, and prior to the Kyoto global warming conference held in December. First-year sales were nearly 18,000.
- 1997-1999: A small selection of **all-electric cars from the big automakers** — including Honda's EV Plus, GM's EV1 and S-10 electric pickup, a Ford Ranger pickup, and Toyota's RAV4 EV — were introduced **in California**. Despite the enthusiasm of early adopters, the electrics failed to reach beyond a few hundred drivers for each model. Within a few years, the all-electric programs were dropped.

History



Honda Insight



Honda Civic IMA

- 1999: **Honda** released the two-door **Insight**, the first hybrid car to hit the mass market in the United States. The Insight won numerous awards and received EPA mileage ratings of 61 mpg city and 70 mpg highway.
- 2000: Toyota released the **Toyota Prius I**, the first hybrid four-door sedan available in the United States
- 2002: Honda introduced the Honda Civic Hybrid, its second commercially available hybrid gasoline-electric car. The appearance and drivability of the Civic Hybrid was (and still is) identical to the conventional Civic

History



Toyota Prius II



Ford Escape

- 2004: The **Toyota Prius II** won 2004 Car of the Year Awards from Motor Trend Magazine and the North American Auto Show. Toyota was surprised by the demand and pumped up its production from 36,000 to 47,000 for the U.S. market. Interested buyers waited up to six months to purchase the 2004 Prius.
- 2005: **Ford** released the Escape Hybrid, the first American hybrid and the first SUV hybrid. Toyota also released several models equipped with hybrid propulsion system **Lexus** RX400h, Lexus GS300h etc.
- 2007: Toyota sold one million of Prius II around the world

History

Electric Vehicles on Sale

Top selling highway-capable electric cars and light utility vehicles produced since 2008 through June 2013			
Model	Market launch	Global sales	Sales through
Nissan Leaf	Dec 2010	> 69,000	June 2013
Mitsubishi i-MiEV family	Jul 2009	~ 25,600	June 2013
Tesla Model S	Jun 2012	12,700	June 2013
Renault Kangoo Z.E.	Oct 2011	9,633	June 2013
Chery QQ3 EV	Mar 2010	7,105	June 2013
JAC J3 EV	2010	4,918	June 2013
Renault Zoe	Dec 2012	4,818	June 2013
Mitsubishi Minicab MiEV	Dec 2011	4,627	June 2013
Renault Fluence Z.E.	2011	3,518	June 2013
Smart electric drive	2009	> 3,100	June 2013
BYD e6	May 2010	2,854	June 2013
Tesla Roadster	Mar 2008	~ 2,500	Dec 2012
Bolloré Bluecar	Dec 2011	2,200	June 2013



Nissan Leaf



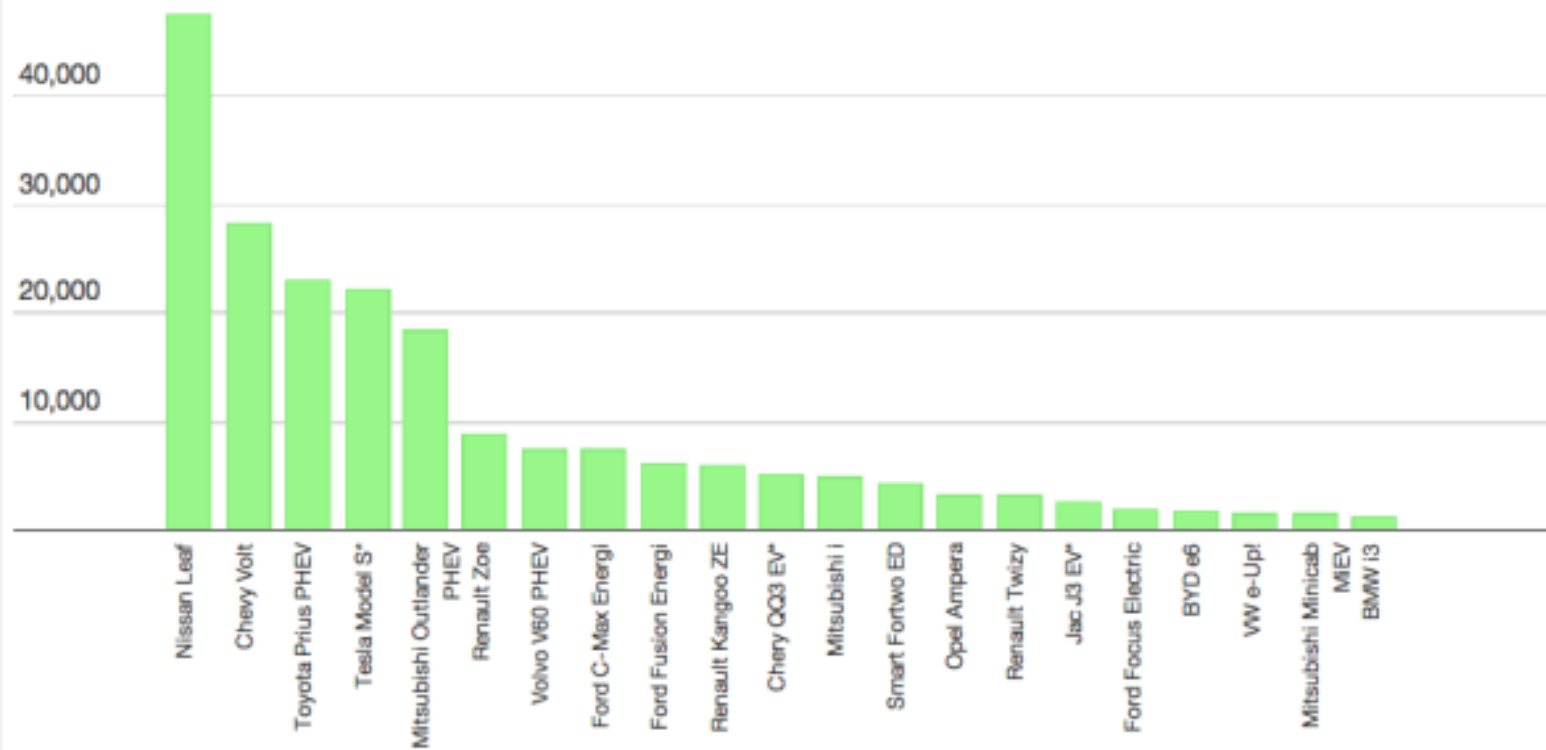
Mitsubishi i-MiEV



Tesla Model S

History

World Electrified Vehicle Sales 2013



Created with [Datawrapper](#)

Source: [EV Obsession](#), [Get the data](#)

History



Renault Twizy, Zéro, Fluence, Kangoo



Nissan Leaf



Mitsubishi Miev, Citroën C-zéro, Peugeot ion



Smart EV



Tesla

History

- Evolution of electric vehicle towards smaller urban car (L7)



Bikes and four wheeled bikes



Reva electric



Renault Twizy



Zen car



Electric bikes



Segway



E-Scooters

Plug-in hybrids



Opel Ampera



Toyota Prius Plug-in hybrid

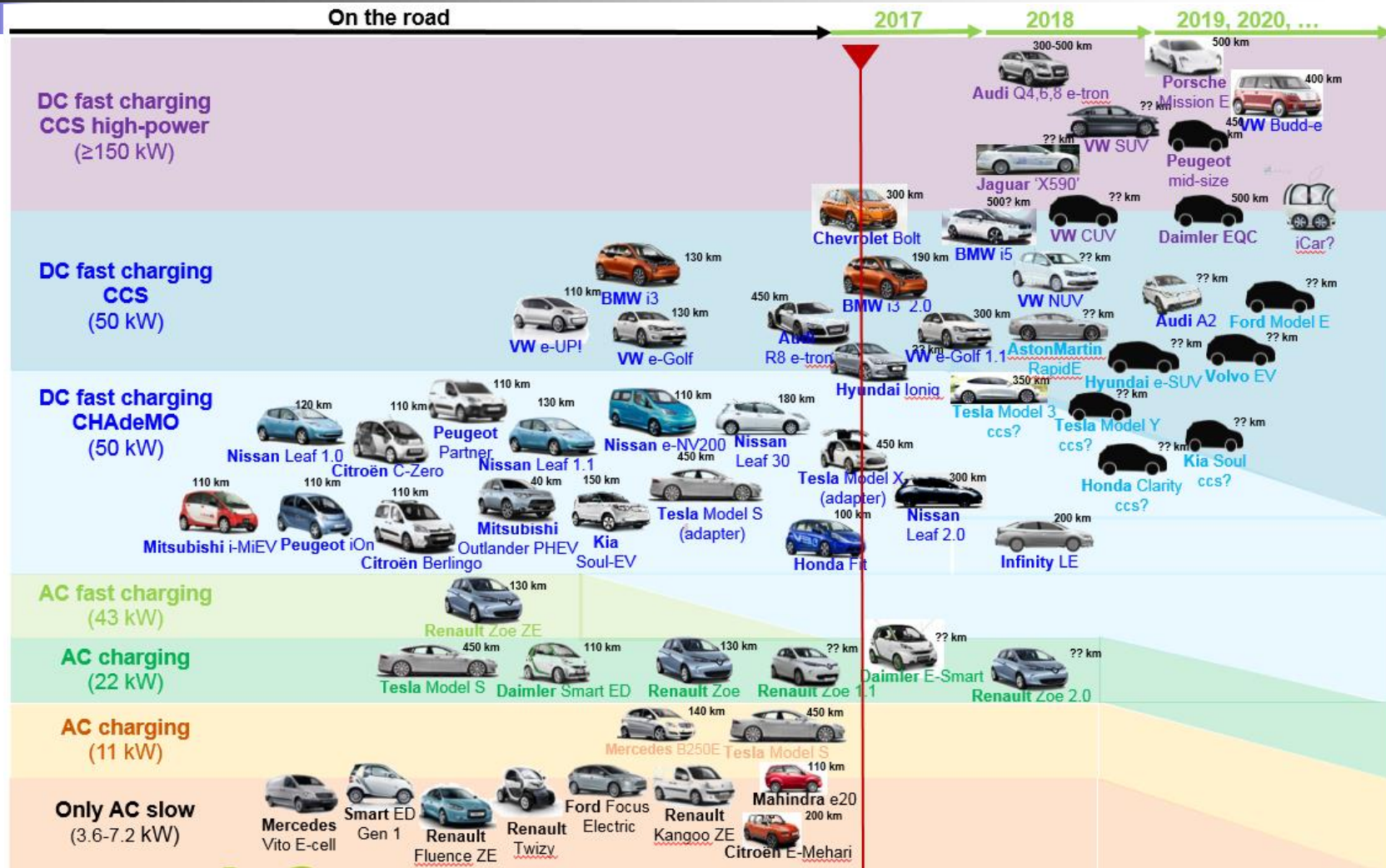


VW Passat GTE



Porsche Cayenne S E Hybrid

Present situation of market



OEMs recognize the potential of EVs

Recent announcements by OEMs suggest they now recognise the potential for EVs to offer a strong consumer proposition

VW Group

Sales: 9.93m



- 30 new BEVs by 2025
- Annual sales of 2-3m electric cars by 2025, equivalent to 20-25% of total sales

Ford

Sales: 6.64m



- Investing \$4.5bn in EVs by 2020
- 13 electrified nameplates by 2020 (40% of total)

Nissan

Sales: 5.42m



- 20% of European sales electric by 2020
- Leaf and e-NV200 currently 6% of sales in Europe

BMW

Sales: 2.25m



- Targeting 100,000 EV sales in 2017
- Plug-in and hybrids to make up 15-25% sales by 2025

Mercedes-Benz

Sales: 2.00m



- 100,000 EVs sold per year by 2020
- Currently sells 2 BEVs, 3 PHEVs. Long range BEV expected 2017

General Motors

Sales: 5.88m



- Chevrolet Bolt, a 200 mile BEV, will be sold as Opel Ampera-e in Europe from 2017

PSA Group

Sales: 2.97m



- 4 new BEVs, 7 new PHEVs to be released between 2019 and 2021

Hyundai-Kia

Sales: 5.0m (est.)



- 2 BEVs, and 6 PHEVs in the range by 2020

Honda

Sales: 4.37m

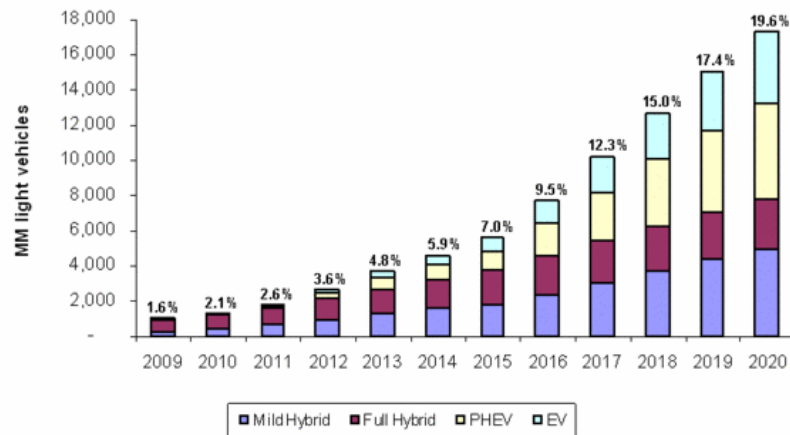


- BEV and PHEV variants of Clarity model in 2017
- 2/3 line-up electrified by 2030 (15% FCV/BEV, 50% HEV/PHEV)

Perspectives

Global HEV/PHEV/EV Market Projections

Global xEV Volume by Type (Million Units), Percentage Global Vehicle Sales



Source: Deutsche Bank, Electric Cars: Plugged In 2, November 3, 2009

Parc total VE 2020:

Scénario 2A: 304k

Scénario 2B: 708k

Car Manufacturers



Sales of EV and HEV (VE + PHEV) :
Up-to 26% of the vehicle sales in Belgium by 2020 (???)

Perspectives

- Forecast by ERTRAC strategic agenda

