

How do WE get to the zero-carbon highway?

Science Capital - Low Carbon 2014

Millennium Point, Birmingham

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The Liberty Electric Cars group

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AGENDA

- History of road transport
- Innovation
- Drivers
- The zero-carbon highway?

years. Some estimate that more than 100,000 patents helped create the modern car.

fusion, engines used pressurized steam to convert linear to rotational motion enabling the powering of a wide range of manufacturing machinery.

converts electrical energy into motion. These engines were not created one-by-one, but rather their development overlapped as new technological discoveries were made.

type of hydrogen vehicle which uses a fuel cell to produce its on-board motive power. Fuel cells create electricity to power an electric motor taking hydrogen or a reformer hydrocarbon fuel and oxygen from the air.

temperature and pressure gases produced by combustion applies direct force to some component of the engine, such as pistons.

INTERNAL COMBUSTION ENGINE SECTION
The force from combustion moves the pistons over a distance, generating useful mechanical energy.

HYDROGEN FUEL CELL CROSS SECTION
The hydrogen tank passes some molecules to the oxygen reservoir, feeding the car with electric charge.

200 years

FERDINAND VERBIEST
Built the first steam-powered, but passenger-less, vehicle.



IVAN KILIBURN
1780-1791, Starts working on a human-pedaled carriage with a steam engine.



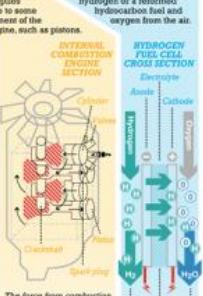
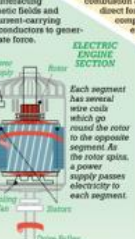
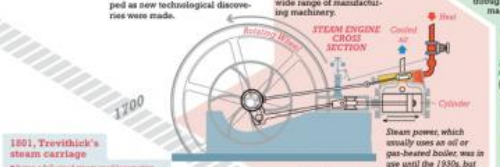
WILLIAM MITCHELL
Built a working model of a steam carriage.



RICHARD TREVITHICK
Ran the first full-sized vehicle on the road in Great Britain.

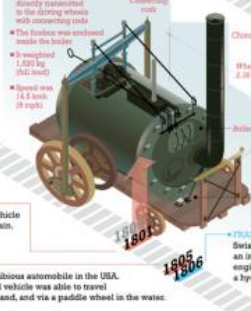


OLIVER EVANS
Built the first amphibious automobile in the USA. His steam-powered vehicle was able to travel on road/treads on land, and via a paddle wheel in the water.


1801, Trevithick's steam carriage

- It was a full-sized steam road locomotive and vehicle.
- One of the first engines directly transmitted its driving wheels with connecting rods.
- The boiler was enclosed inside the boiler.
- It weighed 1,230 kg (2,715 lbs).
- It was 14 ft high.
- It had 8 hp.



1771, Cugnot's "Fardier à vapeur"

- An experimental vehicle intended to transport cannons for the French Army.
- The vehicle weighed around 3.5 metric tons.
- It was intended to transport 1 metric ton of a traveling speed of 2.5 mph, plus 2 passengers.




1832-1839, Robert Anderson's first electric carriage

- A battery-powered car for short-cable electric carriage.
- It was powered by non-rechargeable primary cells.



1859, Joseph Cugnot's "Fardier à vapeur"

- An experimental, steam-driven artillery tractor.



1888, Benz Patent

- Patent granted as the first combination.
- It was produced by a single manufacturer.
- Four-wheeled patent engine.
- It was made of iron.
- It had a steering wheel.
- It had a steering wheel.
- It had a steering wheel.




1865, Joseph Bozot's steam car

- A professor at Prague Polytechnic built an oil-fired steam car.



1826, Samuel Brown's hydrogen-filled internal combustion engine

- English man who tests his hydrogen-filled internal combustion engine.



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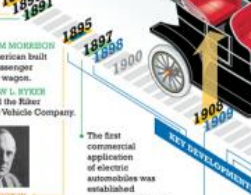
1879, Otto and Langen's one-cylinder, 400-pound engine

- Produced a one-cylinder, 400-pound engine that had an enclosed crankshaft.
- He filed for a patent for the engine and its use in a 4-wheeled car.



1895, Ford Model T assembly line production

- Introduced mass production for the Model T.



1895, Thomas Davenport's first American DC electrical motor

- Invented the first American DC electrical motor, which he installed in a small model car that he operated on a circular electrified track.



1859, Robert Davidson's electric locomotive

- The Scotsman built an electric locomotive that attained a speed of 4 miles per hour (6 km/h).



1859, Nikolaus Otto's internal combustion engine

- Created a hipposomobile with a hydrogen-gas-filled one-cylinder internal combustion engine, and made a test drive from Paris to Jouville-le-Pont. Later versions were propelled by coal gas.




1899, William Morrison's six-passenger electric wagon

- The American built a six-passenger electric wagon.



1906, Ford Model T assembly line production

- Introduced mass production for the Model T.



1901, Clifton Tractor

- The world's first tractor with a steering wheel.



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1913, Electric ignition system

- Patented by Arrol-Johnston.



1913, Hydraulic brakes

- Invented by Malcolm Loughead.



1913, Indian Lancia Lambda

- The first car to feature a load-bearing monocoque-type body and it also pioneered the use of an independent front suspension.




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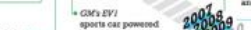
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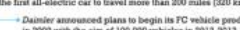
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INDUSTRY BACKGROUND

Car industry

- 70 million cars worldwide
- Enormous, mature industry
- internal combustion engine

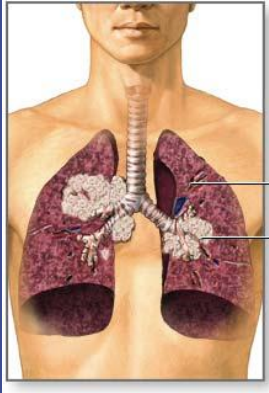


Electrics Sector

- Innovations - 12 phase motors
- Energy storage –battery, KERS
- Electric vehicles invented 1835
- reliable technology - electric trains



INDUSTRY BACKGROUND



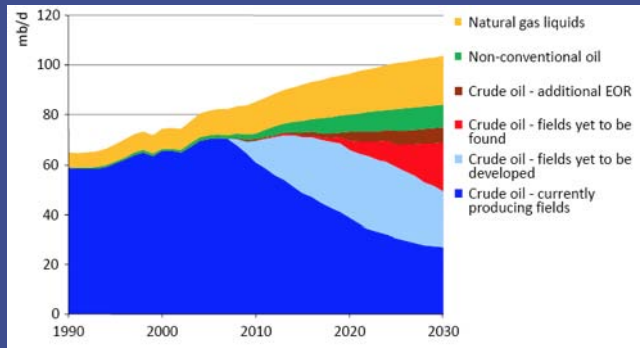
themes (converging?)

- HEALTH: reduce deaths, cancers.
- ENVIRONMENT. Global Warming / Climate Change
- ENERGY – running out of oil?

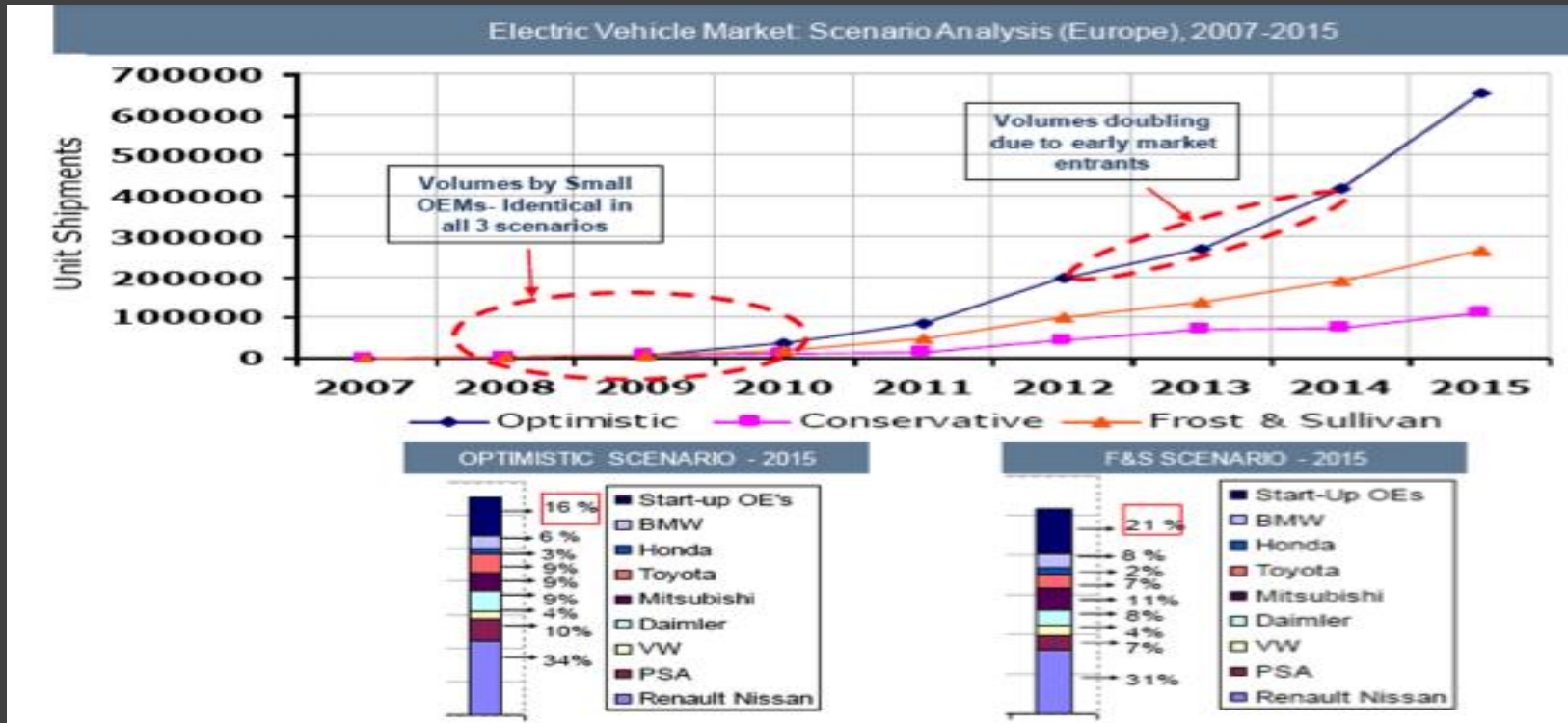


Government action

- Higher taxes for higher polluting cars
 - Road Tax, Congestion charges, fines for OEMs from 2015



RAPID GROWTH FORECASTED (?)



- Volkswagen: EV's will be 15% of global cars sales by 2020
- Business Insights: 1m EV's in America by 2015, 1.2m in UK

INFRASTRUCTURE?

THE RISE OF ELECTRIC CAR CHARGING

Presented by Recargo, PlugShare and PluginCars.com

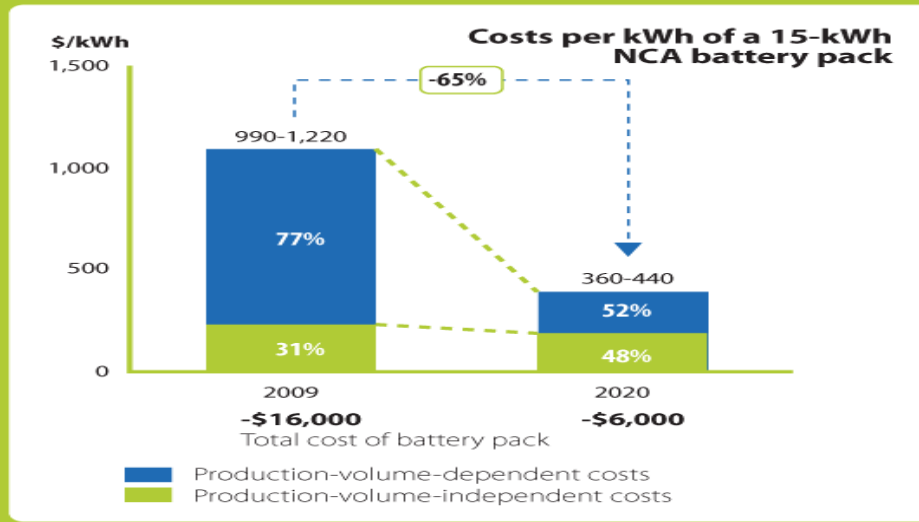
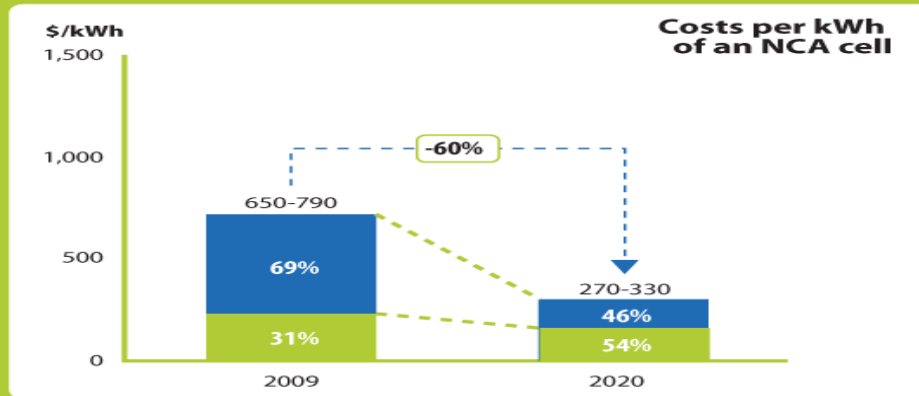
by Jan 2011 ● **1,972** charging stations



by Jan 2012 ● **6,310** charging stations



REDUCTION IN FUEL CELL COSTS



Forecast of battery cell price reduction.

Sources: Interviews with component manufacturers, cell producers, tier one suppliers, OEMs, and academic experts; Argonne National Laboratory; BCG analysis.

THE WORLD'S FIRST PURE ELECTRIC 4x4

- Range – 200 miles (330 km)
- 0-60mph circa 7 seconds (0- 100kph)
- top speed 100mph (160kph)
- Largest battery pack ever installed in an EV



THE UPS AND DOWNS OF INNOVATION

BYD

- Leading Chinese battery-maker.
- Berkshire Hathaway founder Warren Buffett invests US\$230M for 10%



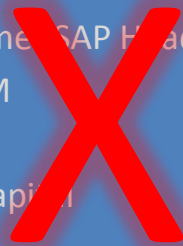
Tesla

- Founding Investors:
 - Elon Musk
 - Draper Fisher Jurvetson
 - JP Morgan
- Daimler \$50M for 9% stake
- \$82.5M series F led by Fjord.
- \$465m from DOE
- Toyota buy\$ \$50m during IPO



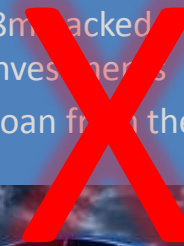
Project Better Place

- Founded by former SAP Head Shai Agassi
- Raised US\$700M
 - Israel Corp.
 - Maniv Energy Capital
 - Morgan Stanley
 - Vantage Point

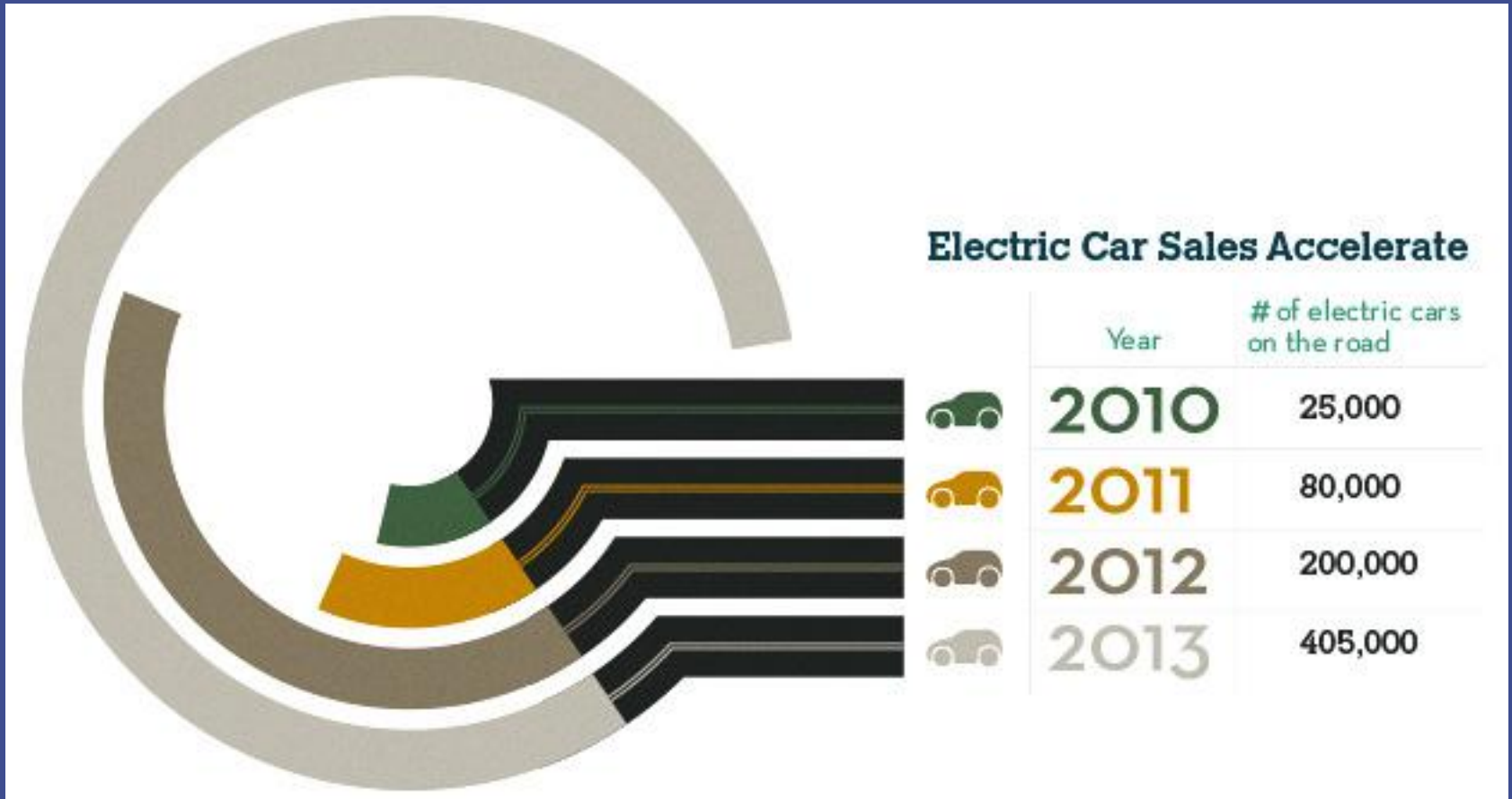


Fisker

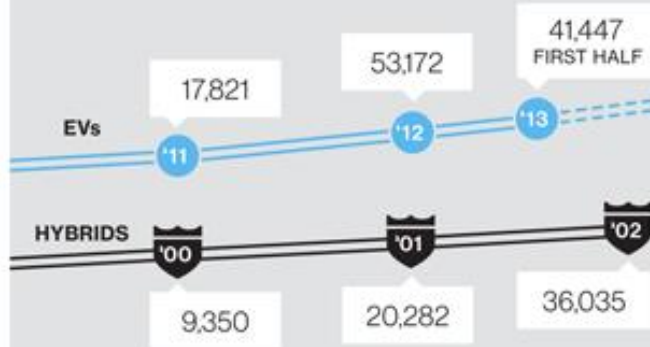
- Raises over \$178m backed by Kleiner Perkins, Paolo Alto and Qatar investors
- Secures \$529m loan from the DOT



EV SALES



the first three years after their introduction in the U.S. exceeded the number of hybrids sold in their first three years. Last year, 435,000 hybrids were sold in the U.S., or 3 percent of the market.



TOP 5 COUNTRIES FOR EVs

These account for nearly 80 percent of the world's overall stock.

Country	Stock
U.S.	71,174
JAPAN	44,727
FRANCE	20,000
CHINA	11,573
U.K.	8,183

1897 Electric vehicles enter the New York City taxi fleet.

1888 German engineer Andreas Flocken builds what is widely considered the world's first four-wheeled electric car.

AVERAGE EMISSIONS PER MILE
Pounds of CO₂

1912 Worldwide electric-vehicle stock reaches 30,000.

1930s Electric vehicles are made virtually obsolete by cheap gasoline for cars with internal-combustion engines.

.87
INTERNAL COMBUSTION

.62
PLUG-IN HYBRID

.57
HYBRID

.54
ALL-ELECTRIC

CHEAPER BATTERIES

Some \$8.7 billion in R&D spending by governments worldwide has helped to lower the cost of batteries. That means electric cars can cost less or have longer ranges for the same price.



1997 Toyota begins selling the Prius, the world's first commercial hybrid, in Japan.

1996 To meet California emission standards, General Motors produces and begins leasing the EV1.

"HYBRID" refers to vehicles that, like the Toyota Prius, combine an internal-combustion engine with one or more electric motors but do not draw electricity from the grid. "Electric vehicle" refers to both plug-in hybrids like the Chevrolet Volt and plug-in vehicles powered solely by a battery, like the Nissan Leaf.

2010 Nissan releases the all-electric Leaf.

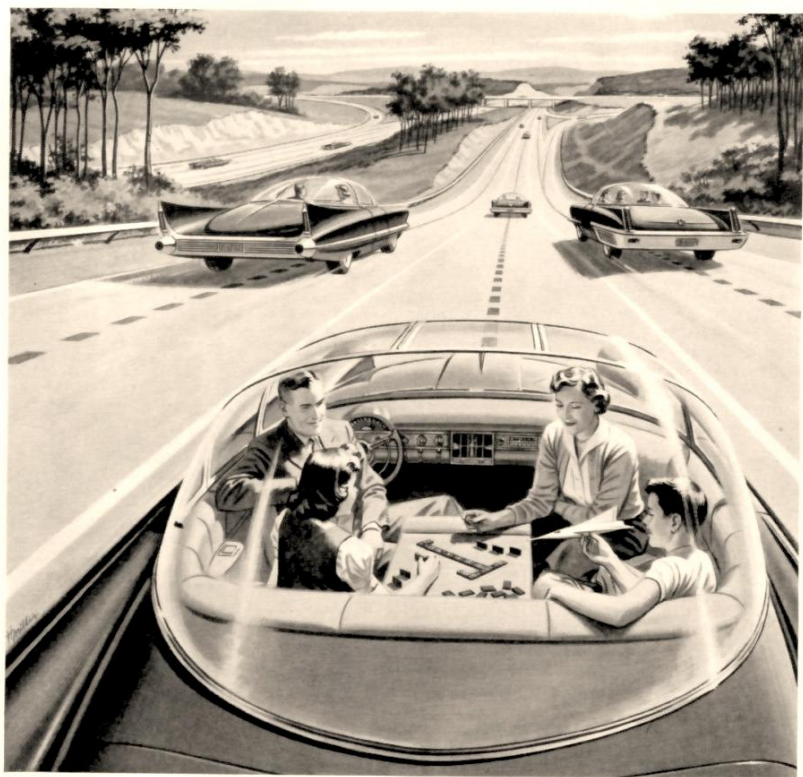
2011 Global EV stock hits new peak of 50,000.

2012 Global EV stock passes 180,000.

PERSONAL RAPID TRANSIT (PRT)



THE DRIVER-LESS CAR



ELECTRICITY MAY BE THE DRIVER. One day your car may speed along an electric super-highway, its speed and steering automatically controlled by

electronic devices embedded in the road. Highways will be made safe—by electricity! No traffic jams . . . no collisions . . . no driver fatigue.



THE CONSUMER?

- 62% concerned about air pollution
- 74% concerned about country`s dependence on oil
- 99.9% - fashion
- 100% - value

CONCLUSIONS

- Fossil Fuels have, and will, dominate
- For who is 'green' a priority?
- Can politicians be long-term?



How do WE get to
the zero-carbon highway?

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“if it is to be, it is up to me”

END OF PRESENTATION



合作协议

该合作协议由下列各方于 2010 年 5 月 27 日签署，其目的与目标如下定

(1)甲方：中国电子科技集团公司第二十七研究所（下称甲方），所地址：河南郑州市郑东新区博学路 1000 号

(2)乙方：库柏科技（北京）有限公司（下称乙方），公司地址：中国北京市城区新街口外大街 28 号 A 座 212 房。

£30M PLAN TURNS GAS-GUZZLERS INTO GREEN MACHINES

Liberty launches eco Range Rover

By TIM RUDGE

All members have the green prospect of owners as the general purpose, low-emission, newly launched Liberty Electric Cars is about to commence a £30 million plan to convert a fleet of thousands of heavy green vehicles. It is announced that a Liberty in the West Country will initially deliver one of the first such zero-emission conversions, the Range Rover, into an environmentally friendly electric-powered car.

The conversion, which hopes to create about 200 jobs, also has plans for other conversions of other models.

But with the environmentally green and healthy will be able to afford the zero carbon-emitting 4x4s. They are expected to cost between £100,000 and £120,000 - nearly double the price of a standard Range Rover.

Another advantage is Liberty's plan to be the most range of the car - only 200

CARBON NEUTRAL. The converted Range Rover will cost up to £120,000




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