Electric Vehicles

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General Motors EV1

An electric vehicle is a vehicle whose motion is provided by electric motors. The motion may be provided either by wheels or propellors driven by rotary motors, or in the case of tracked vehicles, by linear motors. The electrical energy used to power the motors may be obtained from a direct connection to land-based generation plants, as is common in electric trains; from chemical energy stored on the vehicle in batteries or diesel fuel; from nuclear energy, on nuclear submarines and aircraft carriers; or more esoteric sources such as flywheels, wind and solar.

The reasons electric motors are used to drive vehicles are their fine control, high efficiency and simple mechanical construction. Electric motors often achieve 90% conversion efficiency over the full range of speeds and power output and can be precisely controlled. Electric motors can provide torque whilst not moving, unlike internal combustion engines, and do not need gears to match power curves. This removes the need for gearboxes, torque convertors and differentials. Electric motors also have the unusual ability to convert movement energy back into electricity, through regenerative braking. This can be used to reduce the wear on brake systems, and reduce the total energy requirement of a journey.

Most electric transport is directly connected to stationary sources of energy through the grid. Due to the extra infrastructure and difficulty in handling arbitrary travel, most directly connected vehicles are owned publicly or by large companies. These forms of transportation are covered in more detail in maglev trains, metros, trams, trains and trolleybuses. A hypothetical electric vehicle design is Personal rapid transit, a cross between cars and trains optimised for independent travel.

In most systems the motion is provided by a rotary electric motor. However, some trains unroll their motors to drive directly against a special matched track. These are called linear motor trains. Often these are also magnetic levitation trains, floating above the rails through magnetic force. Note that the levitation and the forward motion are independent effects: while the forward motive forces still require external power, Inductrack achieves levitation at low speeds without any.

Chemical energy is the most common independent energy source. Chemical energy is converted to electrical energy, which is then regulated and fed to the drive motors. Chemical energy is usually in the form of diesel or petrol. The fuel is usually converted into electricity by a generator powered by an internal combustion engine or other heat engine. This approach is known as diesel-electric or gas-hybrid locomotion.

Another form of chemical to electrical conversion is electro-chemical. This includes fuel cells and batteries. By avoiding an intermediate mechanical step the conversion efficiency is dramatically improved over the chemical-thermal-mechanical-electrical-mechanical process already discussed. This is due to the higher carnot efficiency through directly oxidising the fuel and by avoiding several unnecessary energy conversions. Furthermore, electro-chemical batteries conversions are easy to reverse, allowing electrical energy to be stored in chemical form.

Despite the higher efficiency, electro-chemical vehicles have many technical issues which prevent them from replacing the more cumbersome heat engines. Heat engines have been easier to scale up, with the largest electrical generators always being driven by heat engines. Fuel cells are fragile, sensitive to contamination, and require external reactants such as hydrogen. Batteries require highly refined and unstable chemicals that could be harmful to the environment and must be recycled to minimize their impact and maximize their sustainability through material reuse. Both have lower energy and power density than heat engines.

For especially large electric vehicles, namely submarines and aircraft carriers, the chemical energy of the diesel-electric can be replaced by a nuclear reactor. The nuclear reactor usually provides heat, which drives a steam turbine, which drives a generator, which is then fed to the propulsion.

There have been a number of experiments using flywheel energy storage in electric vehicles. The flywheels store energy as rotation, which is converted to electricity via a generator, which then drives the wheel motors. It might seem odd to convert rotational energy to electrical energy, only to convert it back, but flywheels need to spin very fast to store enough energy to be useful, and it is easier to use electricity to convert the motion to something suitable for the vehicle.

There are two commonly available electric vehicle designs for automobiles: Battery Electric Vehicles or BEVs, which

convert chemical energy to electrical energy in batteries; and Hybrid vehicles, which convert chemical energy to electrical energy via an internal combustion engine and a generator.

Other light personal mobility devices include electric wheelchairs, the Segway HT, electric scooters, motorized bicycles, golf carts and neighborhood electric vehicles. Working electric vehicles include heavy work equipment, fork lifts, and numerous other service and support vehicles. Strictly technology-proving experimental or solar powered vehicles include sun racers, electrathons, the aerial Helios Prototype, and some rocket propulsion systems such as the ion thruster. Contents

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History Main article: history of the electric vehicle

Edison and an electric car, 1913 (courtesy of the National Museum of American History)

Electric motive power started with a small railway operated by a miniature electric motor, built by Thomas Davenport in 1835. In 1838, a Scotsman named Robert Davidson built an electric locomotive that attained a speed of four miles an hour. In England a patent was granted in 1840 for the use of rails as conductors of electric current, and similar American patents were issued to Lilley and Colten in 1847. http://mikes.railhistory.railfan.net/r066.html

Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland invented the first crude electric carriage, powered by non-rechargable Primary cells. http://inventors.about.com/library/weekly/aacarselectrica.htm

By the 20th century, electric cars and rail transport were commonplace, with commercial electric automobiles having the majority of the market. Electrified trains were used for coal transport as the motors did not use precious oxygen in the mines. Switzerland's lack of natural fossil resources forced the rapid electrification of their rail network.

Electric vehicles were among the earliest automobiles, and before the preeminence of light, powerful internal combustion engines, electric automobiles held many vehicle land speed and distance records in the early 1900s. They were produced by Anthony Electric, Baker Electric, Detroit Electric, and others and at one point in history out-sold gasoline-powered vehicles. [edit]

Future

Eliica Battery Electric Car with 370 km/h top speed and 200 km range

The future was unclear because of the low range and small lifespan of the batteries. But there are several developments which could bring back electric vehicles outside of their current field of application -- namely operational yards and indoor operation. The first improvement[1] was to decouple the electric motor from the battery through electronic control while employing ultra-capacitors to buffer large but short power demands and recoverable braking energy. The development of new cell types compared with intelligent cell management improved both weak points mentioned above. The cell management is not only able to monitor the health of the cells but by having a redundant cell configuration (one cell more than needed) and a sophisticated switched wiring it is possible to condition one cell after the other while the rest are on duty. Perhaps the most important point is that a monovalent operation (electric only) is no longer considered dogma. The use of fuel cells instead of internal combustion engines can create propulsion systems that are nearly emissions-free (regarding local emissions). [edit]

Electric vehicles and the automotive industry

Most major automakers have attempted to postpone or prevent mass production of electric cars. At one time during emissions reductions regulations GM produced over 500 of their EV1 models. Shortly after modification of emissions reduction regulations, GM recalled and crushed their electric cars.

EV1s crushed by General Motors shortly after production [edit]

See also
- Action on Climate Change
- Battery electric vehicle
- Electric vehicle conversion

- Hybrid vehicle
- Hydrogen vehicle
- Ion drive
- Magnetohydrodynamics
- Mitigation of global warming
- Plug-in hybrid electric vehicle
- Renewable energy
- Steam car Retrieved from "http://en.wikipedia.org/wiki/Electric_vehicle"