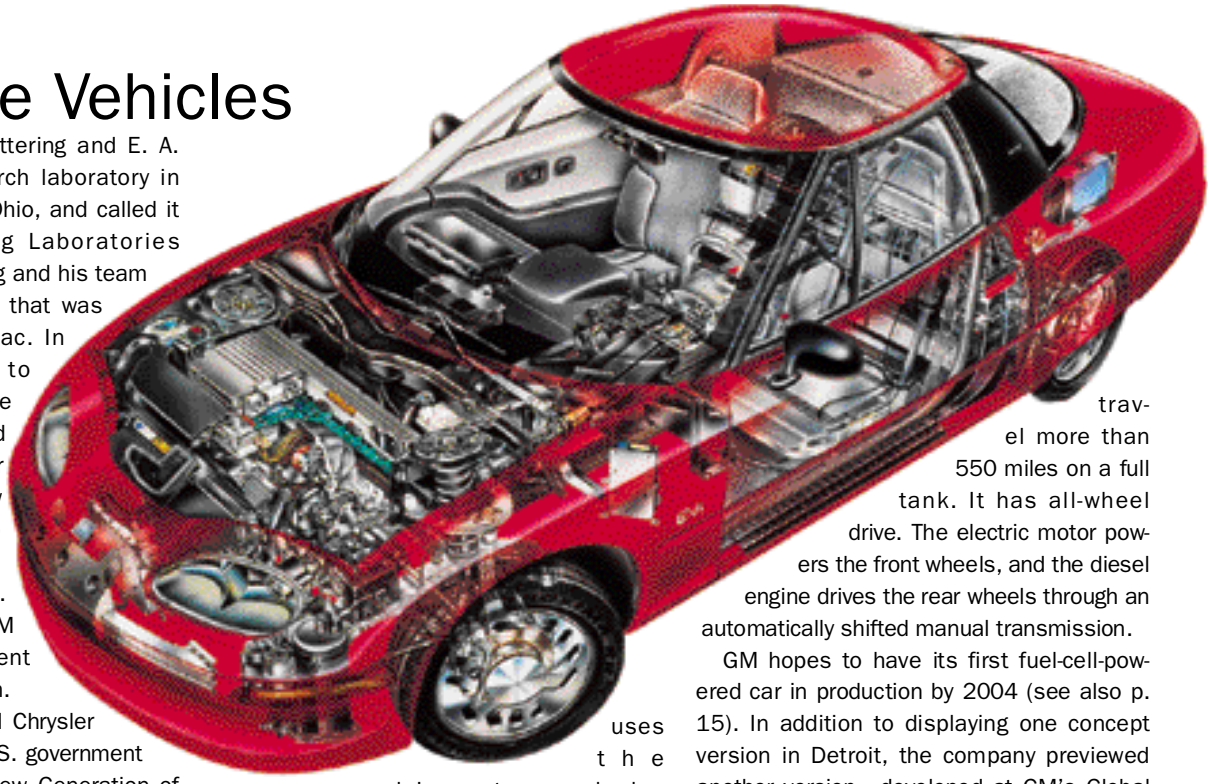
Alternative Vehicles



In 1909, Charles E. Kettering and E. A. Deeds set up a research laboratory in Deeds's barn in Dayton, Ohio, and called it the Dayton Engineering Laboratories Company (Delco). Kettering and his team developed the self-starter that was used in the 1912 Cadillac. In 1916, Delco was sold to what would become General Motors, and Kettering formed another company. He sold this new company in 1919 again to GM and ran the new GM Research Corporation. Today, this is the GM Research and Development Center in Warren, Michigan.

In 1993, GM, Ford, and Chrysler joined together with the U.S. government in the Partnership for a New Generation of Vehicles. The goal of this partnership is to develop a production vehicle with three times the fuel efficiency of a 1993 car by 2004. GM delivered the first production all-electric car in 1996 and has continued to develop higher-efficiency engines and alternatives to the combustion-engine vehicle. In fact, GM is developing several different ideas for vehicle propulsion in parallel, thus covering all possibilities while technologies develop for each. Five different types of advanced research vehicles that GM is currently working on may lead to new concept or production vehicles. These five are an all-electric, a compressed-natural-gas, a series- and a parallel-hybrid (gas and electric), and a fuel-cell-powered car. GM displayed its two prototype hybrids and a fuel-cell vehicle last January at the North American International Auto Show in Detroit.

The first car produced by GM with a non-combustion engine is the all-electric EV1 (see illustration), which emits no particulate matter or other burn products. It uses a 312-V pack of 26 valve-regulated, lead-acid (VRLA) batteries for energy. It travels from 50 to 90 miles on a charge and takes 90 minutes for a partial charge to 3 hours for a full charge using an inductive charger. Like all GM vehicles with battery packs, the EV1 features regenerative braking, a technology that uses the propulsion motor as a brake, which generates electricity that is then stored in the batteries. Thus, stop-and-go traffic helps to charge the battery.

Another GM vehicle in development uses a compressed-natural-gas (CNG) engine. CNG burns cleaner and is less expensive than regular gasoline. Refueling could be done in 3.5 minutes at a service station or overnight at home using a compressor and the natural gas used for cooking or heating. The CNG vehicle can travel about 350 miles between refills. While this engine is similar to the standard car engine, it is by no means the same. The transmission uses a steel belt and two variable diameter pulleys to create a continuously variable ratio transmission

Two new GM concept vehicles are hybrid cars. Both cars rely on an internal-combustion (IC) engine and a stack of 44 nickel metal hydride (NiMH) batteries to supply power. Each car can be driven in a "zero-emissions mode" with the IC engine off, or in a "hybrid mode" with the engine running to charge the batteries. The series hybrid, which uses a gas-turbine engine running on reformulated gasoline, can travel 350 miles on the 6.5-gallon tank. It uses an electric motor to power the vehicle's front wheels and produces ultralow levels of exhaust emissions. The parallel hybrid uses diesel fuel and can travel more than 550 miles on a full tank. It has all-wheel drive. The electric motor powers the front wheels, and the diesel engine drives the rear wheels through an automatically shifted manual transmission.

GM hopes to have its first fuel-cell-powered car in production by 2004 (see also p. 15). In addition to displaying one concept version in Detroit, the company previewed another version—developed at GM's Global Alternative Propulsion Center (GAPC) with headquarters at Mainz-Kastel near Rüsselsheim, Germany—in September at the Paris motor show. Besides its German center, GM has GAPC research centers in Warren, Michigan, and Rochester, New York, which are also working on this technology.

The fuel cell is like a battery in that chemical reactions at the electrodes convert chemical energy into electrical energy. However, the reactants are stored outside of the fuel cell and are fed into the stack. In this vehicle, GM has chosen to use methanol as a source of hydrogen, which is combined with oxygen at the electrodes to form water and heat. GM is also investigating using a special fuel-cell-compatible form of gasoline as a fuel and, ultimately, pure hydrogen. The energy conversion efficiency of these fuel cells is approaching 45%. In these concept vehicles, the travel range is more than 300 miles.

Fuel cells are not a new technology—they were used aboard NASA spacecraft in the 1960s, and some utility companies employ them—but their application to power passenger cars is new.

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