

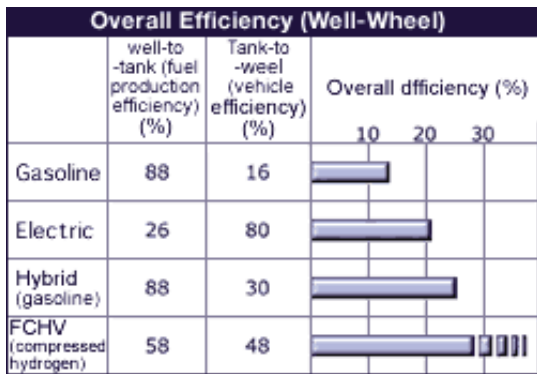
Fuel Cell Hybrid Vehicles

Imagine if the only compound your car emitted was a vapor of pure, clean H₂O. That's right—water. It's one of two products created in the chemical process that takes place inside a fuel cell. The other is electricity.

But an FC vehicle is not just another electric car—the challenges don't end when the fuel cell is installed. The FCHV-4, our latest experimental fuel cell hybrid vehicle, incorporates a fuel cell and a battery to ensure a constant supply of electrical power. To manage this hybrid combination of power sources, we've incorporated the same computerized control technologies as are used in the THS. Powered by pure compressed hydrogen, the FCHV-4 is a sports utility vehicle with kick. Its Toyota FC stack outputs an amazing 90kW—more than four times that of our first FCHV in 1996. This gives it a top speed of over 150km/h, and a cruising range of 250km or more.



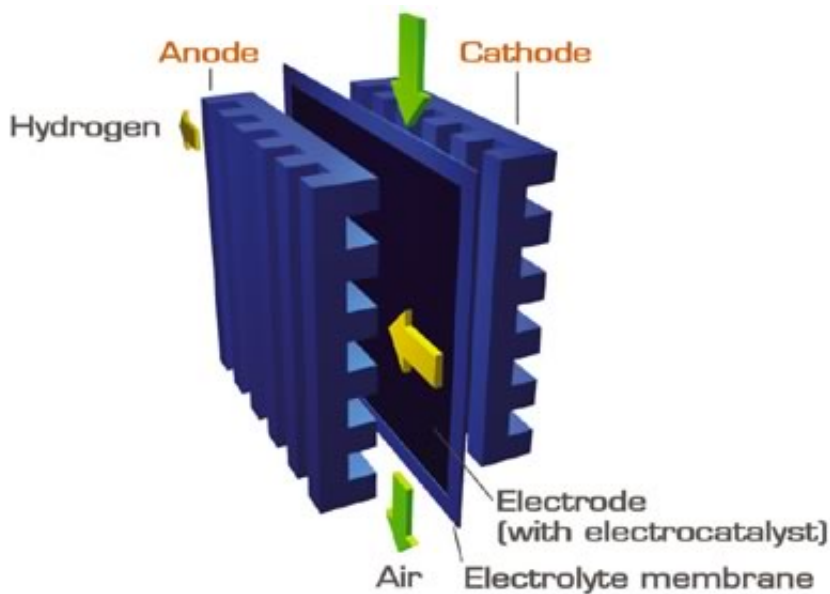
FCHV—Cleaner, More Efficient



Source: Toyota in-house testing

Well-to-wheel represents the overall efficiency of an energy source, from the time it's extracted from the ground to when it actually turns the wheels of the vehicle. It's one good indicator of the environmental cost of a particular fuel technology, and it can show some surprising results. For example, a gasoline-powered hybrid vehicle is actually less wasteful overall than an electric car. The most efficient form of propulsion, though, is an FCHV, more than twice as efficient as a gasoline-powered automobile.

How A Fuel Cell Works



Fuel cells work on the principle of reverse electrolysis. Just as you can apply an electric current to water and split it into hydrogen and oxygen, you can also reverse this process to make electricity. Recent technological developments have shrunk fuel cells down small enough to fit under a car's back seat—the one we have developed uses stacks of proton exchange membranes, each one only a few tenths of a millimeter thick, that allow only the proton of the hydrogen molecule to pass through. This creates the voltage differential that powers the car.

Road Testing in Japan



The FCHV-4 is our first fuel cell hybrid vehicle to be licensed for testing on Japan's public roads. The tests, which began in June, 2001, will be carried out over a period of three years, and will measure the car's performance on highways, steep hills, and other demanding environments.

Road Testing in the USA



Toyota is a member of the California Fuel Cell Partnership (CaFCP), a joint project that includes California and federal government agencies, energy companies, auto manufacturers, and fuel cell stack manufacturers, working together to lay the foundation for fuel cell commercialization. We began testing the FCHV-4 on California roads in July, 2001, as part of our participation in this project.