Fuel Cell Electricity

First used by NASA to provide electricity, heat and drinkable water in spacecraft throughout the 1960s, fuel cells have become one of our most promising clean energy technologies. In the not-too-distant future, fuel cells running on renewable fuels will provide clean, reliable, and sustainable electricity for vehicles, homes and businesses throughout California and the world.

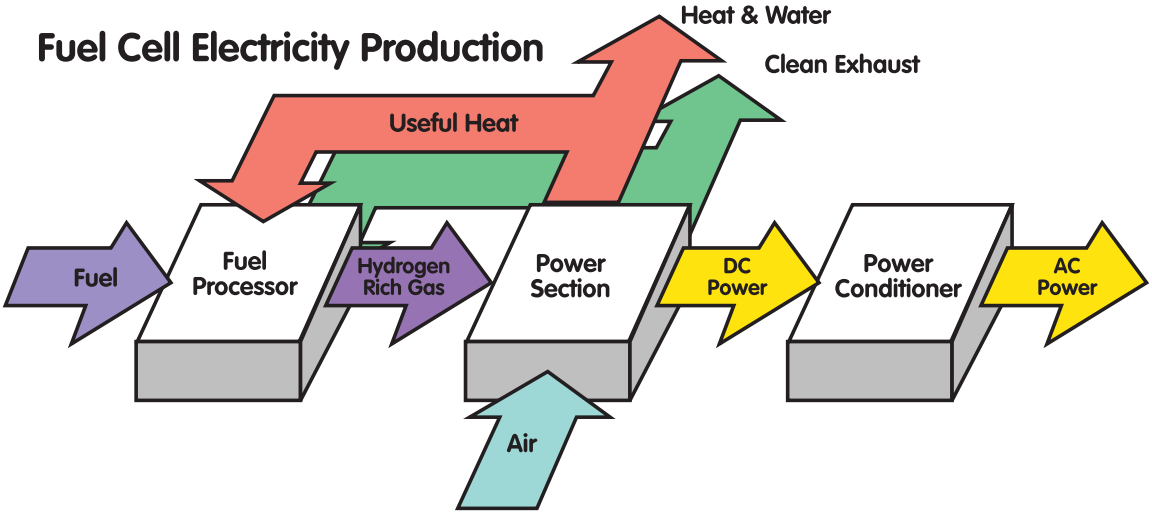
RENEWABLE ENERGY PROGRAM
CALIFORNIA ENERGY COMMISSION

The power of fuel cells

What is a fuel cell?

A fuel cell is similar to a battery. Fuel cells convert hydrogen and oxygen to water vapor, obtaining direct current (DC) electricity from the reaction. Like batteries, fuel cells supply this DC electricity via reactions between their positive and negative anodes. Also like batteries, fuel cells can be stacked in a series to increase the electrical output of the system. But unlike batteries, fuel cells don't store energy or require recharging. Only hydrogen and oxygen are required to keep fuel cells running. Any fuel containing hydrogen, such as natural gas, methane, butane, propane, and even water, can supply the necessary hydrogen for the reaction. Air circulating through the fuel cell provides the necessary oxygen. Fuel cell systems include a power conditioning section, in which the DC electricity produced by the reaction is converted into the alternating current (AC) electricity consistent with the utility grid and used in most businesses and homes.

The variety of fuels available offers important choices for fuel cell owners. Inexhaustible, renewable resources, such as methane (captured from decomposing organic material) and ethanol (manufactured from organic material such as corn) can be converted to electricity using a fuel cell. This puts to valuable use the noxious waste gases emitted from landfills and agricultural operations, gases that would otherwise be released into the atmosphere or burned off. Fuel cells can also be used in tandem with other renewable energy producers, such as wind turbines or photovoltaics, to provide constant electricity production from intermittent sources like the sun or wind. For example, a wind turbine can power the separation of hydrogen from water using electrolysis. The hydrogen can then be stored to provide fuel to the fuel cell whenever electricity is needed. Harnessing these renewable energy sources reduces our dependence on fossil fuels and diversifies our energy options, while protecting the environment.



Why are fuel cells important?

Fuels cells provide clean, reliable electricity at a fuel economy superior to that of traditional combustion methods. Fuel cells convert 40-80 percent of available fuel to electricity, compared with 20-30 percent conversion for traditional combustion power plants, conserving natural resources and reducing fuel costs.

Since fuel cells use a low-temperature chemical reaction between hydrogen and oxygen to produce electricity, they do not emit the harmful air emissions associated with combustion. The only by-products from fuel cell electricity production are heat, often cycled back for use in the fuel processing unit, and sterile water, usually in the form of steam.

Fuel cells operate quietly and generate power continually. This is especially important for facilities that rely on high-grade, computer-quality power to maintain operations such as hospitals, high-tech companies, communications centers, and public safety operations.

The future of fuel cells

Fuel cells already provide primary and back-up power for a range of commercial operations including hotels, hospitals, manufacturing plants, and retail shopping centers. In the near future, you can expect to see fuel cells used to produce electricity for smaller businesses and for homes. Many major car manufacturers have also developed demonstration vehicles that incorporate fuel cells. Fuel cell buses are in service in some California cities, shuttling residents without the use of gasoline.

Fuel cells already assume many shapes and sizes to accommodate many different applications. And as the number of fuel cell applications increase, as is expected over the coming decades, the variety of fuel cells and their uses will expand as well.

Harness the Power All Around Us

For more information on renewable energy sources
www.consumerenergycenter.org

State of California
Arnold Schwarzenegger, Governor

California Energy Commission
Joseph Desmond, Chairman
Jackalyne Pfannenstiel, Vice Chair

Commissioners
Arthur H. Rosenfeld, Ph.D.
James D. Boyd
John L. Geesman

B. B. Blevins, Executive Director

Printed with soy inks on recycled paper that contains at least 30% post-consumer fiber.
CEC-300-2005-006-FS